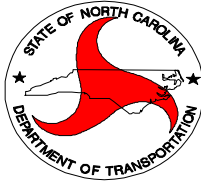


STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION



DIVISION 2 – TRAFFIC SERVICES

CONTRACT PROPOSAL

TIP NUMBER: SS-4902AB
WBS ELEMENT: 42597.3.1
ROUTE: NC 58
COUNTY: Carteret
DESCRIPTION: Advanced Queue Detection Warning System on NC 58
Bridge Over Intracoastal Waterway
BID OPENING: Tuesday, March 9, 2010

NOTICE:

ALL BIDDERS SHALL COMPLY WITH ALL APPLICABLE LAWS REGULATING THE PRACTICE OF GENERAL CONTRACTING AS CONTAINED IN CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA WHICH REQUIRES THE BIDDER TO BE LICENSED BY THE N.C. LICENSING BOARD FOR CONTRACTORS WHEN BIDDING ON ANY NON-FEDERAL AID PROJECT WHERE THE BID IS \$50,000 OR MORE, EXCEPT FOR CERTAIN SPECIALTY WORK AS DETERMINED BY THE LICENSING BOARD OR SBE PROJECT. BIDDERS SHALL ALSO COMPLY WITH ALL OTHER APPLICABLE LAWS REGULATING THE PRACTICES OF ELECTRICAL, PLUMBING, HEATING AND AIR CONDITIONING AND REFRIGERATION CONTRACTING AS CONTAINED IN CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA.

NAME OF BIDDER

N.C. CONTRACTOR'S LICENSE NUMBER

ADDRESS OF BIDDER

RETURN BIDS TO:

N. C. DEPARTMENT OF TRANSPORTATION
Attn: Aaron Bullard, PE
105 Pactolus Highway
P O Box 1587
Greenville, NC 27835-1587

Per items 11 - 13 of the instructions on page 2

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INSTRUCTIONS TO BIDDERS

PLEASE READ ALL INSTRUCTIONS CAREFULLY BEFORE PREPARING AND SUBMITTING YOUR BID.

All bids shall be prepared and submitted in accordance with the following requirements. Failure to comply with any requirement shall cause the bid to be considered irregular and shall be grounds for rejection of the bid.

1. The bid form furnished by NCDOT with the proposal shall be used and shall not be altered in any manner. **DO NOT SEPARATE THE BID FORM FROM THE PROPOSAL!**
2. All entries on the bid form, including signatures, shall be written in ink.
3. The Bidder shall submit a unit price for every item on the bid form. The unit prices for the various contract items shall be written in figures. Unit prices shall be limited to two (2) decimal places.
4. An amount bid shall be entered on the bid form for every item. The amount bid for each item shall be determined by multiplying each unit bid by the quantity for that item, and shall be written in figures in the "Amount Bid" column of the form.
5. The total amount bid shall be written in figures in the proper place on the bid form. The total amount shall be determined by adding the amounts bid for each item.
6. Changes in any entry shall be made by marking through the entry in ink and making the correct entry adjacent thereto in ink. A representative of the Bidder shall initial the change in ink.
7. The bid shall be properly executed. All bids shall show the following information:
 - a. Name of individual, firm, corporation, partnership, or joint venture submitting bid.
 - b. Name and signature of individual or representative submitting bid and position or title.
 - c. Name, signature, and position or title of witness.
 - d. Federal Identification Number (or Social Security Number of Individual)
 - e. Contractor's License Number (if Applicable)
8. Bids submitted by corporations shall bear the seal of the corporation.
9. The bid shall not contain any unauthorized additions, deletions, or conditional bids.
10. The bidder shall not add any provision reserving the right to accept or reject an award, or to enter into a contract pursuant to an award.
11. **THE PROPOSAL WITH THE BID SHEET STILL ATTACHED SHALL BE PLACED IN A SEALED ENVELOPE AND SHALL HAVE BEEN DELIVERED TO AND RECEIVED IN THE DIVISION TWO ENGINEER'S OFFICE AT 105 PACTOLUS HIGHWAY, GREENVILLE, NC 27834 BY 10:00 AM ON TUESDAY, MARCH 9, 2010.**
12. The sealed bid must display the following statement on the front of the sealed envelope:

**ATTN: AARON BULLARD, PE
QUOTATION FOR NC 58 ADVANCED QUEUE DETECTION WARNING SYSTEM
TO BE OPENED AT 10:00 AM ON TUESDAY, MARCH 9, 2010**

13. If delivered by mail, the sealed envelope shall be placed in another sealed envelope and the outer envelope shall be addressed as follows:

**NC DEPARTMENT OF TRANSPORTATION
ATTN: AARON BULLARD, PE
PO BOX 1587
GREENVILLE, NC 27835-1587**

AWARD OF CONTRACT

The award of the contract, if it be awarded, will be made to the lowest responsible bidder in accordance with Section 102 (*excluding 102-2 and 102-11*) of the Standard Specifications for Roads and Structures 2006. The lowest responsible bidder will be notified that his bid has been accepted and that he has been awarded the contract. NCDOT reserves the right to reject all bids.

DIVISION CONTRACT
PROJECT SPECIAL PROVISIONS - GENERAL

DESCRIPTION:

This contract is for the installation of an advanced queue detection warning system on NC 58 on both sides of the bridge over the Intracoastal Waterway between Cape Carteret and Emerald Isle in Carteret County. The Contractor shall furnish all services, labor, and equipment necessary for the execution of said work. The Contractor shall provide sufficient personnel experienced in the construction and maintenance of traffic signal equipment.

All work and materials shall be in accordance with the provisions of the General Guidelines of this contract, the Project Special Provisions, the North Carolina Department of Transportation *Standard Specifications for Roads and Structures, July 2006*, the North Carolina Department of Transportation *Roadway Standard Drawings, July 2006*, and the current edition of the *Manual of Uniform Traffic Control Devices* (MUTCD).

The Contractor shall keep himself fully informed of all Federal, State, and Local laws, ordinances, and regulations, and shall comply with the provisions of Section 107 of the *2006 Standard Specifications*.

PURCHASE ORDER CONTRACT PREQUALIFICATION:

Beginning **July 1, 2009**, any firm that wishes to perform work on Division Purchase Order Contracts as either the prime contractor or as a subcontractor on the project must be prequalified for the type of work they wish to perform. Firms that wish to bid on these projects as the prime contractor must be prequalified prior to submitting a bid. Firms that wish to perform as a subcontractor to the prime contractor must be prequalified prior to beginning work on the project.

For the purposes of prequalification, any firm that is currently prequalified as a prime or a subcontractor on central let projects for the appropriate work codes is considered eligible to work and/or bid on Purchase Order Contracts as long as other items such as bonding and license requirements for the contract are met.

Information regarding the requirements to become prequalified as a Purchase Order Contract contractor, including the application to become prequalified if you are not already prequalified, can be found at the following website: <http://www.ncdot.org/business/howtogetstarted/>.

CONTRACT TIME AND LIQUIDATED DAMAGES:

(7-1-95)(Rev. 12-18-07)

SP1G10

The date of availability for this contract is **March 29, 2010**.

The completion date for this contract is **September 24, 2010**.

Except where otherwise provided by the contract, observation periods required by the contract will not be a part of the work to be completed by the completion date and/or intermediate contract times stated in the contract. The acceptable completion of the observation periods that extend beyond the final completion date shall be a part of the work covered by the performance and payment bonds.

The liquidated damages for this contract are **Five Hundred Dollars (\$500.00)** per calendar day.

INTERMEDIATE CONTRACT TIME NUMBER 1 AND LIQUIDATED DAMAGES

(2-20-07)

SP1 G14 A

The Contractor shall complete the required work of installing, maintaining, and removing the traffic control devices for lane closures and restoring traffic to the existing traffic pattern. The Contractor shall not close or narrow a lane of traffic on during the following time restrictions:

DAY AND TIME RESTRICTIONS

From June 1, 2010 through September 2, 2010:
Friday 3:00 P.M. to Sunday 6:00 P.M.

In addition, the Contractor shall not close or narrow a lane of traffic on NC 58 or any adjacent side street, detain and/or alter the traffic flow on or during holidays, holiday weekends, special events, or any other time when traffic is unusually heavy, including the following schedules:

HOLIDAY AND HOLIDAY WEEKEND LANE CLOSURE RESTRICTIONS

1. For **unexpected occurrence** that creates unusually high traffic volumes, as directed by the Engineer.
2. For **New Year's Day**, between the hours of 5:00 p.m. December 31st and 7:00 a.m. January 2nd. If New Year's Day is on a Friday, Saturday, Sunday or Monday, then until 7:00 a.m. the following Tuesday.
3. For **Easter**, between the hours of 3:00 p.m. Thursday and 6:00 p.m. Sunday.
4. For **Memorial Day**, between the hours of 12:00 p.m. Friday and 6:00 p.m. Monday.
5. For **Independence Day**, between the hours of 6:00 p.m. the day before Independence Day and 7:00 a.m. the day after Independence Day.

If **Independence Day** is on a Friday, Saturday, Sunday or Monday, then between the hours of 3:00 p.m. the Thursday before Independence Day and 6:00 p.m. the Monday after Independence Day.

6. For **Labor Day**, between the hours of 3:00 p.m. Friday and 6:00 p.m. Monday.
7. For **Thanksgiving Day**, between the hours of 5:00 p.m. Tuesday and 7:00 a.m. Monday.
8. For **Christmas**, between the hours of 5:00 p.m. the Friday before the week of Christmas Day and 7:00 a.m. the following Tuesday after the week of Christmas Day.

Holidays and holiday weekends shall include New Year's, Easter, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas. The Contractor shall schedule his work so that lane closures will not be required during these periods, unless otherwise directed by the Engineer.

The time of availability for this intermediate contract work shall be the time the Contractor begins to install all traffic control devices for lane closures according to the time restrictions listed herein.

The completion time for this intermediate contract work shall be the time the Contractor is required to complete the removal of all traffic control devices for lane closures according to the time restrictions stated above and place traffic in the existing traffic pattern.

The liquidated damages are **Five Hundred Dollars (\$500.00)** per hour.

NO MAJOR CONTRACT ITEMS:

(2-19-02) (Rev 8-21-07)

SP1 G31

None of the items included in this contract will be major items.

NO SPECIALTY ITEMS:

(7-1-95)

SP1 G34

None of the items included in this contract will be specialty items (See Article 108-6 of the *Standard Specifications*).

**MINORITY BUSINESS ENTERPRISE AND WOMEN BUSINESS ENTERPRISE:
(PO & MUNICIPALITIES)**

(10-16-07) (10-20-09)

SP1G68

Policy

It is the policy of the North Carolina Department of Transportation that Minority Business Enterprises (MBEs) and Women Business Enterprises (WBEs) as defined in *GS 136-28.4* shall have the equal opportunity to compete fairly for and to participate in the performance of contracts financed in whole or in part by State Funds.

Obligation

The Contractor, subcontractor, and sub-recipient shall not discriminate on the basis of race, religion, color, creed, national origin, sex, handicapping condition or age in the performance of this contract. The Contractor shall comply with applicable requirements of *GS 136-28.4* in the award and administration of state funded contracts. Failure by the Contractor to comply with these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the Department deems necessary.

Definitions

Commitment - The approved MBE/WBE participation submitted by the prime contractor during the bidding process.

Committed MBE/WBE - Any MBE/WBE listed on the MBE/WBE commitment list approved by the Department at the time of bid submission or any MBE/WBE utilized as a replacement for a MBE/WBE firm listed on the commitment list.

Department (DOT)- North Carolina Department of Transportation (See Municipality)

Municipality – The entity letting the contract, when this provision refers to the Department or DOT, it shall mean the municipality, if applicable.

Minority Business Enterprise (MBE) – A firm certified as a Disadvantaged Minority-Owned Business Enterprise through the North Carolina Unified Certification Program.

Women Business Enterprise (WBE) – A firm certified as a Disadvantaged Women-Owned Business Enterprise through the North Carolina Unified Certification Program.

MBE/WBE – This term is used for convenience only. Minority Business Enterprise and Women Business Enterprise are not interchangeable terms and the goals for either or both are not interchangeable.

Goal - The MBE/WBE participation specified herein

Letter of Intent – Written documentation of the bidder/offeror's commitment to use a MBE/WBE subcontractor and confirmation from the MBE/WBE that it is participating in the contract.

Manufacturer - A firm that operates or maintains a factory or establishment that produces on the premises the materials or supplies obtained by the Contractor.

Regular Dealer - A firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials or supplies required for the performance of the contract are bought, kept in stock, and regularly sold to the public in the usual course of business. A regular dealer engages in, as its principal business and in its own name, the purchase and sale or lease of the products in question. A regular dealer in such bulk items as steel, cement, gravel, stone, and petroleum products need not keep such products in stock, if it owns or operates distribution equipment. Brokers and packagers are not regarded as manufacturers or regular dealers within the meaning of this section.

Form RS-1-D - Form for subcontracts involving MBE/WBE subcontractors attesting to the agreed upon unit prices and extensions for the affected contract items.

North Carolina Unified Certification Program - A program that provides comprehensive information to applicants for certification, such that an applicant is required to apply only once for a MBE/WBE certification that will be honored by all recipients of USDOT funds in the state and not limited to the Department of Transportation only. The Certification Program is in accordance with *49 CFR Part 26*.

Standard Specifications – The general term comprising all directions, provisions, and requirements contained or referred to in the *North Carolina Department of Transportation Standard Specifications for Roads and Structures* and any subsequent revisions or additions to such book that are issued under the title *Supplemental Specifications*.

Contract Goal

The following goals for participation by Minority Business Enterprises and Women Business Enterprises are established for this contract.

(A) Minority Business Enterprises 0 %

- (1) *If the goal is more than zero*, the Contractor shall exercise all necessary and reasonable steps to ensure that Minority Business Enterprises participate in at least the percent of the contract as set forth above as the goal.
- (2) *If the goal is zero*, the Contractor shall continue to recruit the MBEs and report the use of MBEs during the construction of the project. A good faith effort will not be required with a zero goal.

(B) Women Business Enterprises 0 %

- (1) *If the goal is more than zero*, the Contractor shall exercise all necessary and reasonable steps to ensure that Women Business Enterprises participate in at least the percent of the contract as set forth above as the goal.
- (2) *If the goal is zero*, the Contractor shall continue to recruit the WBEs and report the use of WBEs during the construction of the project. A good faith effort will not be required with a zero goal.

Contract Requirement

The approved MBE/WBE participation submitted by the Contractor shall be the **Contract Requirement**.

Certified Transportation Firms Directory

Real-time information about firms doing business with the Department and firms that are certified through North Carolina's Unified Certification Program is available in the Directory of Transportation Firms. The Directory can be accessed by the link on the Department's homepage or by entering <https://apps.dot.state.nc.us/vendor/directory> in the address bar of your web browser. Only firms identified as MBE/WBE certified in the Directory can be utilized to meet the contract goals.

The listing of an individual firm in the Department's directory shall not be construed as an endorsement of the firm's capability to perform certain work.

Listing of MBE/WBE Subcontractors in Contract

Only those MBE/WBE firms with current certification are acceptable for listing in the bidder's submittal of MBE/WBE participation. The Contractor shall indicate the following required information:

- (A) *If the goal is more than zero* bidders, at the time the bid proposal is submitted, shall submit a listing of MBE/WBE participation on the appropriate form (or facsimile thereof) contained elsewhere in the contract documents in order for the bid to be considered responsive. Bidders shall indicate the total dollar value of the MBE/WBE participation for the contract. If the bidder has no MBE/WBE participation, he shall indicate this on the form "Listing of MBE/WBE Subcontractors" by entering the word or number zero. This form shall be completed in its entirety. **Blank forms will not be deemed to represent zero participation.** Bids submitted that do not have WBE/MBE participation indicated on the appropriate form will not be read publicly during the opening of bids. The Department will not consider these bids for award and the proposal will be returned to the bidder.
- (B) *If the goal is zero*, bidders at the time the bid proposal is submitted, shall enter the word "zero" or number "0" or if there is participation, add the value on the "Listing of MBE/WBE Subcontractors" (or facsimile thereof) contained elsewhere in the contract documents.

Written Documentation – Letter of Intent

The bidder shall submit written documentation of the bidder/offeror's commitment to use MBE/WBE subcontractors whose participation it submits to meet a contract goal and written confirmation from each MBE/WBE, listed in the proposal, indicating their participation in the contract. This documentation shall be submitted on the Department's form titled "Letter of Intent to Perform as Subcontractor". This letter

of intent form is available at: <http://www.ncdot.org/doh/preconstruct/ps/contracts/letterofintent.pdf>. It shall be received in the office of the Division Contract Officer no later than 12:00 PM of the sixth calendar day following opening of bids.

If the bidder fails to submit the letter of intent from each committed MBE/WBE listed in the proposal indicating their participation in the contract, the MBE/WBE participation will not count toward meeting the goal.

Counting MBE/WBE Participation Toward Meeting MBE/WBE Goal of Zero or More

- (A) If a firm is determined to be an eligible MBE/WBE firm, the total dollar value of the participation by the MBE/WBE will be counted toward the contract requirement. The total dollar value of participation by a certified MBE/WBE will be based upon the value of work actually performed by the MBE/WBE and the actual payments to MBE/WBE firms by the Contractor.
- (B) When a MBE/WBE performs as a participant in a joint venture, the Contractor may count toward its MBE/WBE goal a portion of the total value of participation with the MBE/WBE in the joint venture, that portion of the total dollar value being a distinct clearly defined portion of work that the MBE/WBE performs with its forces.
- (C)
 - (1) The Contractor may count toward its MBE/WBE goal only expenditures to MBE/WBEs that perform a commercially useful function in the work of a contract. A MBE/WBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially useful function, the MBE/WBE shall also be responsible with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material and installing (where applicable) and paying for the material itself. To determine whether a MBE/WBE is performing a commercially useful function, the Department will evaluate the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the contract is commensurate with the work it is actually performing and the MBE/WBE credit claimed for its performance of the work, and other relevant factors.
 - (2) A MBE/WBE may enter into subcontracts. Work that a MBE/WBE subcontracts to another MBE/WBE firm may be counted toward the contract goal. Work that a MBE/WBE subcontracts to a non-MBE/WBE firm does not count toward the contract goal. If a MBE/WBE contractor or subcontractor subcontracts a significantly greater portion of the work of the contract than would be expected on the basis of standard industry practices, the MBE/WBE shall be presumed not to be performing a commercially useful function. The MBE/WBE may present evidence to rebut this presumption to the Department for commercially useful functions. The Department's decision on the rebuttal of this presumption will be final.
 - (3) The following factors will be used to determine if a MBE/WBE trucking firm is performing a commercially useful function.
 - (a) The MBE/WBE shall be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there shall not be a contrived arrangement for the purpose of meeting MBE/WBE goals.

- (b) The MBE/WBE shall itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
 - (c) The MBE/WBE receives credit for the total value of the transportation services it provides on the contract using trucks it owns, insures, and operates using drivers it employs.
 - (d) The MBE/WBE may lease trucks from another MBE/WBE firm, including an owner-operator who is certified as a MBE/WBE. The MBE/WBE who leases trucks from another MBE/WBE receives credit for the total value of the transportation services the lessee MBE/WBE provides on the contract.
 - (e) The MBE/WBE may also lease trucks from a non-MBE/WBE firm, including from an owner-operator. The MBE/WBE who leases trucks from a non-MBE/WBE is entitled to credit for the total value of transportation services provided by non-MBE/WBE lessees not to exceed the value of transportation services provided by MBE/WBE-owned trucks on the contract. Additional participation by non-MBE/WBE lessees receives credit only for the fee or commission it receives as a result of the lease arrangement. The value of services performed under lease agreements between the MBE/WBE and Contractor will not count towards the contract requirement.
 - (f) For purposes of this paragraph, a lease shall indicate that the MBE/WBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the MBE/WBE, so long as the lease gives the MBE/WBE absolute priority for use of the leased truck. Leased trucks shall display the name and identification number of the MBE/WBE.
- (D)** A contractor may count toward its MBE/WBE goals 60 percent of its expenditures for materials and supplies required to complete the contract and obtained from MBE/WBE regular dealer and 100 percent of such expenditures to a MBE/WBE manufacturer.
- (E)** A contractor may count toward its MBE/WBE goals the following expenditures to MBE/WBE firms that are not manufacturers or regular dealers:
- (1) The fees or commissions charged by a MBE/WBE firm for providing a bona fide service, such as professional, technical, consultant, or managerial services, or for providing bonds or insurance specifically required for the performance of a DOT-assisted contract, provided the fees or commissions are determined to be reasonable and not excessive as compared with fees and commissions customarily allowed for similar services.
 - (2) The fees or commissions charged for assistance in the procurement of the materials and supplies, or for transportation charges for the delivery of materials or supplies required on a job site (but not the cost of the materials and supplies themselves), provided the fees are not from a manufacturer or regular dealer and provided the fees are determined to be reasonable and not excessive as compared with fees customarily allowed for similar services.

Good Faith Effort for Projects with Goals more than Zero

If the MBE/WBE participation submitted in the bid by the apparent lowest responsive bidder does not meet or exceed the MBE/WBE contract goals, the apparent lowest responsive bidder shall submit to the Division Contract Officer documentation of its good faith efforts made to reach each contract goal. One complete set and 9 copies of this information shall be received in the office of the Division Contract Officer no later than 12:00 PM of the sixth calendar day following opening of bids. Where the information submitted includes repetitious solicitation letters it will be acceptable to submit a representative letter along with a distribution list of the firms that were solicited. Documentation of MBE/WBE quotations shall be a part of the good faith effort submittal as necessary to demonstrate compliance with the factors listed below which the Department considers in judging good faith efforts. This documentation may include written subcontractor quotations, telephone log notations of verbal quotations, or other types of quotation documentation.

The following factors will be used to determine if the bidder has made adequate good faith effort:

- (A) Whether the bidder attended any pre-bid meetings that were scheduled by the Department to inform MBE/WBEs of subcontracting opportunities.
- (B) Whether the bidder provided solicitations through all reasonable and available means (e.g. advertising in newspapers owned and targeted to the MBE/WBEs at least 10 calendar days prior to bid opening). Whether the bidder provided written notice to all MBE/WBEs listed in the NCDOT Directory of Transportation Firms, within the Divisions and surrounding Divisions where the project is located, that specialize in the areas of work (as noted in the MBE/WBE Directory) that the bidder will be subletting.
- (C) Whether the bidder followed up initial solicitations of interests by contacting MBE/WBEs to determine with certainty whether they were interested. If a reasonable amount of MBE/WBEs within the targeted Divisions do not provide an intent to quote or no MBE/WBEs specialize in the subcontracted areas, the bidder shall notify MBE/WBEs outside of the targeted Divisions that specialize in the subcontracted areas, and call the Director of Business and Opportunity Workforce Development to give notification of the bidder's inability to get MBE/WBE quotes.
- (D) Whether the bidder selected portions of the work to be performed by MBE/WBEs in order to increase the likelihood of meeting the contract goals. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate MBE/WBE participation, even when the bidder might otherwise perform these work items with its own forces.
- (E) Whether the bidder provided interested MBE/WBEs with adequate and timely information about the plans, specifications and requirements of the contract.
- (F) Whether the bidder negotiated in good faith with interested MBE/WBEs without rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities. Any rejection should be noted in writing with a description as to why an agreement could not be reached.
- (G) Whether quotations were received from interested MBE/WBE firms but rejected as unacceptable without sound reasons why the quotations were considered unacceptable.

- (H) Whether the bidder specifically negotiated with subcontractors to assume part of the responsibility to meet the contract MBE/WBE goals when the work to be sublet includes potential for MBE/WBE participation.
- (I) Whether the bidder made any efforts and/or offered assistance to interested MBE/WBEs in obtaining the necessary equipment, supplies, materials, insurance, and/or bonding to satisfy the work requirements in the bid proposal.
- (J) Any other evidence that the bidder submits which show that the bidder has made reasonable good faith efforts to meet the contract goal.

If a bidder is the apparent lowest responsive bidder on more than one project within the same letting located in the same geographic area of the state, as a part of the good faith effort the Department will consider allowing the bidder to combine the MBE participation as long as the MBE overall goal value of the combined projects is achieved.

If a bidder is the apparent lowest responsive bidder on more than one project within the same letting located in the same geographic area of the state, as a part of the good faith effort the Department will consider allowing the bidder to combine the WBE participation as long as the WBE overall goal value of the combined projects is achieved.

If the Department does not award the contract to the apparent lowest responsive bidder, the Department reserves the right to award the contract to the next lowest responsive bidder that can satisfy the Department that the contract goal can be met or that adequate good faith efforts have been made to meet the goal.

MBE/WBE Replacement

The Contractor shall not terminate a committed MBE/WBE subcontractor for convenience or perform the work with its own forces or those of an affiliate. If the Contractor fails to demonstrate reasonable efforts to replace a committed MBE/WBE firm that does not perform as intended with another committed MBE/WBE firm or completes the work with its own forces without the Engineer's approval, the Contractor may be disqualified from further bidding for a period of up to 6 months.

The Contractor shall comply with the following for replacement of committed MBE/WBE.

(A) Performance Related Replacement

When a MBE/WBE is terminated or fails to complete its work on the contract for any reason, the Contractor shall take all necessary, reasonable steps to replace the MBE/WBE subcontractor with another MBE/WBE subcontractor to perform at least the same amount of work as the MBE/WBE that was terminated. The Contractor is encouraged to first attempt to find another MBE/WBE firm to do the same work as the MBE/WBE that was being terminated.

To demonstrate necessary, reasonable good faith efforts, the Contractor shall document the steps they have taken to replace any MBE/WBE subcontractor who is unable to perform successfully with another MBE/WBE subcontractor. Such documentation shall include but not be limited to the following:

- (1) Copies of written notification to MBE/WBEs that their interest is solicited in subcontracting the work defaulted by the previous MBE/WBE subcontractor or in subcontracting other items of work in the contract.
- (2) Efforts to negotiate with MBE/WBEs for specific subbids including, at a minimum:
 - (a) The names, addresses, and telephone numbers of MBE/WBEs who were contacted.
 - (b) A description of the information provided to MBE/WBEs regarding the plans and specifications for portions of the work to be performed.
- (3) For each MBE/WBE contacted but rejected as unqualified, the reasons for the Contractor's conclusion.
- (4) Efforts made to assist the MBE/WBEs contacted, if needed, in obtaining bonding or insurance required by the Contractor.

(B) Decertification Replacement

- (1) When a committed MBE/WBE is decertified by the Department after a Request for Subcontract has been received by the Department, the Department will not require the Prime Contractor to solicit replacement MBE/WBE participation equal to the remaining work to be performed by the decertified firm. The participation equal to the remaining work performed by the decertified firm will count toward the contract requirement.
- (2) When a committed MBE/WBE is decertified prior to the Department receiving a Request for Subcontract for the named MBE/WBE firm, the Prime Contractor shall take all necessary and reasonable steps to replace the MBE/WBE subcontractor with another MBE/WBE subcontractor to perform at least the same amount of work to meet the contract goal or demonstrate that it has made a good faith effort to do so.

Changes in the Work

When the Engineer makes changes that result in the reduction or elimination of work to be performed by a committed MBE/WBE, the Contractor will not be required to seek additional participation. When the Engineer makes changes that result in additional work to be performed by a MBE/WBE based upon the Contractor's commitment, the MBE/WBE shall participate in additional work to the same extent as the MBE/WBE participated in the original contract work.

When the Engineer makes changes that result in extra work, which has more than a minimal impact on the contract amount, the Contractor shall seek additional participation by MBE/WBEs unless otherwise approved by the Engineer.

When the Engineer makes changes that result in an alteration of plans or details of construction and a portion or all of work had been expected to be performed by a committed MBE/WBE, the Contractor shall seek participation by MBE/WBEs unless otherwise approved by the Engineer.

When the Contractor requests changes in the work that result in the reduction or elimination of work that the Contractor committed to be performed by a MBE/WBE, the Contractor shall seek additional participation by MBE/WBEs equal to the reduced MBE/WBE participation caused by the changes.

Reports

All requests for subcontracts involving MBE/WBE subcontractors shall be accompanied by a certification executed by both the Prime Contractor and the MBE/WBE subcontractor attesting to the agreed upon unit prices and extensions for the affected contract items. This information shall be submitted on the Department Form RS-1-D, located at: <http://www.ncdot.org/doh/forms/files/FORMRS-1-D.doc> unless otherwise approved by the Engineer. The Department reserves the right to require copies of actual subcontract agreements involving MBE/WBE subcontractors.

Within 30 calendar days of entering an agreement with a MBE/WBE for materials, supplies or services, not otherwise documented by a Request for Subcontract as specified above, the Contractor shall furnish the Engineer a copy of the agreement. The documentation should also indicate the percentage (60% or 100%) of expenditures claimed for MBE/WBE credit.

All certifications will be considered a part of the project records, and consequently will be subject to penalties under State Law associated with falsifications of records related to projects.

Commitment

MBE/WBE firms submitted with the Letter of Intent to participate in the work shall be used unless otherwise approved by the Department. Provisions for replacement of MBE/WBE firms are included in this provision.

Reporting MBE/WBE Participation

- (A) The Contractor shall provide the Engineer with an accounting of payments made to MBE/WBE firms, including material suppliers, contractors at all levels (prime, subcontractor, or second tier subcontractor). This accounting shall be furnished to the Engineer for any given month by the end of the following month. Failure to submit this information accordingly may result in the following action:
 - (1) Withholding of money due in the next partial pay estimate; or
 - (2) Removal of an approved contractor from the prequalified bidders list or the removal of other entities from the approved subcontractors list.
- (B) The Contractor shall report the accounting of payments on the Department's MBE/WBE Subcontractor Payment Information Form DBE-IS, which is available at <http://www.ncdot.org/doh/forms/files/DBE-IS.xls>. This shall be reported to the Engineer.
- (C) Contractors reporting transportation services provided by non-MBE/WBE lessees shall evaluate the value of services provided during the month of the reporting period only.

Prior to payment of the final estimate, the Contractor shall furnish an accounting of total payment to each MBE/WBE. A responsible fiscal officer of the payee contractor, subcontractor, or second tier subcontractor who can attest to the date and amounts of the payments shall certify that the accounting is correct.

While each contractor (prime, subcontractor, 2nd tier subcontractor) is responsible for accurate accounting of payments to MBE/WBEs, it shall be the prime contractor's responsibility to report all monthly and final payment information in the correct reporting manner.

Because NCDOT funding is being used to fund this project, failure on the part of the Contractor to submit the required information in the time frame specified may result in the disqualification of that contractor and any affiliate companies from further bidding on any NCDOT funded projects until the required information is submitted.

Because NCDOT funding is being used to fund this project, failure on the part of any subcontractor to submit the required information in the time frame specified may result in the disqualification of that contractor and any affiliate companies from further working on any State or Federally funded projects until the required information is submitted.

Failure to Meet Contract Requirements

Failure to meet contract requirements in accordance with Article 102-16(J) of the *Standard Specifications* may be cause to disqualify the Contractor.

LIABILITY INSURANCE:

(11-18-08)

SP1 G80

Page 1-68, Article 107-16 is amended to include the following as the first, second, third and fourth paragraphs:

The Contractor shall be liable for any losses resulting from a breach of the terms of this contract. The Contractor shall be liable for any losses due to the negligence or willful misconduct of its agents, assigns and employees including any sub-contractors which causes damage to others for which the Department is found liable under the Torts Claims Act, or in the General Courts of Justice, provided the Department provides prompt notice to the Contractor and that the Contractor has an opportunity to defend against such claims. The Contractor shall not be responsible for punitive damages.

The Contractor shall at its sole cost and expense obtain and furnish to the Department an original standard ACORD form certificate of insurance evidencing commercial general liability with a limit for bodily injury and property damage in the amount of \$5,000,000.00 per occurrence and general aggregate, covering the Contractor from claims or damages for bodily injury, personal injury, or for property damages which may arise from operating under the contract by the employees and agents of the Contractor. The required limit of insurance may be obtained by a single general liability policy or the combination of a general liability and excess liability or umbrella policy. The State of North Carolina shall be named as an additional insured on this commercial general liability policy. The policy may contain the following language as relates to the State as an additional insured: "This insurance with respect to the additional insured applies only to the extent that the additional insured is held liable for your or your agent's acts or omissions arising out of and in the course of operations performed for the additional insured."

The Contractor shall maintain all legally required insurance coverage, including without limitation, worker's compensation and vehicle liability, in the amounts required by law. Providing and maintaining adequate insurance coverage is a material obligation of the contractor and is of the essence of this contract. All such insurance shall meet all laws of the State of North Carolina. Such insurance coverage shall be obtained from companies that are authorized to provide such coverage and that are authorized by the Commissioner of Insurance to do business in North Carolina. The Contractor shall at all times comply with the terms of such insurance policies.

Upon execution of the contract, provide evidence of the above insurance requirements to the Engineer.

WORKER'S COMPENSATION INSURANCE:

Pursuant to N.C.G.S. § 97-19, all contractors of the Department of Transportation are required, prior to beginning services, to show proof of coverage issued by a workers' compensation insurance carrier, or a certificate of compliance issued by the Department of Insurance for self-insured subcontractors stating that it has complied with N.C.G.S. § 97-93 irrespective of whether subcontractors have regularly in service fewer than three employees in the same business within the State of North Carolina, and subcontractors shall be hereinafter liable under the Workers' Compensation Act for payment of compensation and other benefits to its employees for any injury or death due to an accident arising out of and in the course of performance of the work insured by the subcontractor.

CONTRACTOR'S LICENSE REQUIREMENTS:

(7-1-95)

SP1 G88

If the successful bidder does not hold the proper license to perform any plumbing, heating, air conditioning, or electrical work in this contract, he will be required to sublet such work to a contractor properly licensed in accordance with *Article 2 of Chapter 87 of the General Statutes* (licensing of heating, plumbing, and air conditioning contractors) and *Article 4 of Chapter 87 of the General Statutes* (licensing of electrical contractors).

SUBSURFACE INFORMATION:

(7-1-95)

SP1 G112

There is **no** subsurface information available on this project. The Contractor shall make his own investigation of subsurface conditions.

BIDS:

In accordance with GS 136-28.1(b), if the total bid amount of the contract exceeds \$1,200,000.00, the bid will not be considered for award.

CONTRACT PAYMENT AND PERFORMANCE BOND:

A performance bond in the amount of one hundred percent (100%) of the contract amount, conditioned upon the faithful performance of the contract in accordance with specifications and conditions of the contract is required for Construction contracts of \$300,000 or more. Such bond shall be solely for the protection of the North Carolina Department of Transportation and the State of North Carolina.

A payment bond in the amount of one hundred percent (100%) of the contract amount, conditioned upon the prompt payment for all labor or materials for which the Contractor, or his subcontractors, are liable is required for Construction contracts greater than \$300,000. The payment bond shall be solely for the protection of persons or firms furnishing materials or performing labor for this contract for which the Contractor is liable.

The successful bidder, within ten (10) days after notice of award, shall provide the Department with a contract payment bond and a contract performance bond each in an amount equal to 100 percent of the amount of the contract.

ENGINEER:

The Engineer for this project shall be the Division 2 Engineer, Division of Highways, North Carolina Department of Transportation, acting directly or through a duly authorized representative, such representative acting within the scope of particular assigned duties or authority.

PAYMENT:

The Contractor may submit a request for partial payment on a monthly basis, or other interval as approved by the Engineer. Compensation for all pay items shall be in accordance with the *Standard Specifications*. The amount of partial payments will be based on the work accomplished and accepted as the last day of the approved pay period.

Request for payment shall be made by Contractor's Invoice submitted to:

**North Carolina Department of Transportation
Attention: Resident Engineer
209 S Glenburnie Rd
New Bern, NC 28560**

All invoice items and unit costs shall correspond to contract pay items. In the event of error or discrepancy in items or unit costs, the Department may return the invoice to the Contractor for correction.

Form DBS-IS must be included with all requests for payment in order for that request to be processed. Information included on this form shall reflect actual payments made to DBE/MBE/WBE firms. It is available for download at <http://www.ncdot.org/doh/forms/files/DBE-IS.xls>. A responsible fiscal officer of the payee firm who can attest to the date and amounts of the payments shall certify that the accounting is correct. One hundred percent (100%) payment shall be made after successful completion of the work as verified by the final inspection.

CLAIMS FOR ADDITIONAL COMPENSATION OR EXTENSION OF TIME:

Any claims for additional compensation and/or extensions of the completion date shall be submitted to the Division Engineer with detailed justification within thirty (30) days after receipt of the final invoice payment. The failure of the Contractor to submit the claim(s) within thirty (30) days shall be a bar to recovery.

CONTRACTOR CLAIM SUBMITTAL FORM:

(9-16-08)

SP1G140

If the Contractor elects to file a written claim or requests an extension of contract time, it shall be submitted on the *Contractor Claim Submittal Form (CCSF)* available through the Construction Unit or http://ncdot.org/doh/operations/dp_chief_eng/constructionunit/formsmanuals/.

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC:

(12-19-06)(Rev 3-16-10)

SP1 G151

Revise the *2006 Standard Specifications* as follows:

Page 1-60, 107-2 Assignment of Claims Void, replace the reference from *G.S. 143-3.3* to ***G.S. 143B-426.40A***.

Page 1-69, 107-18 Contractor's Responsibility for Work, in the first paragraph, last sentence, replace the word *legally* with the word *contractually*.

GIFTS FROM VENDORS AND CONTRACTORS:

(12-15-09)

SP1 G152

By Executive Order 24, issued by Governor Perdue, and *N.C. G.S. § 133-32*, it is unlawful for any vendor or contractor (i.e. architect, bidder, contractor, construction manager, design professional, engineer, landlord, offeror, seller, subcontractor, supplier, or vendor), to make gifts or to give favors to any State employee of the Governor's Cabinet Agencies (i.e. Administration, Commerce, Correction, Crime Control and Public Safety, Cultural Resources, Environment and Natural Resources, Health and Human Services, Juvenile Justice and Delinquency Prevention, Revenue, Transportation, and the Office of the Governor). This prohibition covers those vendors and contractors who:

- (1) have a contract with a governmental agency; or
- (2) have performed under such a contract within the past year; or
- (3) anticipate bidding on such a contract in the future.

For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review Executive Order 24 and *G.S. § 133-32*.

Executive Order 24 also encouraged and invited other State Agencies to implement the requirements and prohibitions of the Executive Order to their agencies. Vendors and contractors should contact other State Agencies to determine if those agencies have adopted Executive Order 24.

1. TRAFFIC CONTROL

1.1 DESCRIPTION

Perform appropriate traffic control for all lane and/or shoulder closures. Comply with the NCDOT 2006 Standard Specifications for Road and Structures, the appropriate NCDOT July 2006 Roadway Standard Drawings, the Project Special Provision, and all local ordinances. Notify the Engineer, the Town of Emerald Isle, and the Town of Cedar Point at least 21 calendar days prior to any lane or shoulder closure. Provide each town with a copy of the plans and special provisions to ensure they are aware of the NCDOT traffic control requirements for this project.

1.2 MATERIALS

A. General

Use traffic control devices that conform to all NCDOT requirements and are listed on the NCDOT's Approved Products List as shown on NCDOT's Work Zone Traffic Control website.

In tangent sections, channelizing devices spacing shall not exceed distance in feet equal to twice the posted speed limit.

Place sets of three drums perpendicular to the edge of travel way on 500-ft centers when unopen lanes are closed to traffic. These drums shall be in addition to channelizing devices.

1.3 CONSTRUCTION METHODS

A. Lane Closure Restrictions

From Memorial Day to Labor Day, no lane closures are permitted from 3 PM Friday to 6 PM Sunday.

B. Lane and Shoulder Closures

When personnel and/or equipment are working within 40 feet of an open travel lane, close the nearest open shoulder as illustrated in the NCDOT July 2006 Roadway Standard Drawings.

When personnel and/or equipment are working on the shoulder adjacent to an undivided facility and within 5 feet of an open travel lane, close the nearest travel lane as illustrated in the NCDOT July 2006 Roadway Standard Drawings, unless the work area is protected by an approved temporary traffic barrier or guardrail.

When personnel and/or equipment are working within a lane of travel of an undivided or divided facility, close the lane using the appropriate roadway standard drawing as illustrated in the NCDOT July 2006 Roadway Standard Drawings.

Do not perform work involving heavy equipment within 15 feet of the edge of travel way when work is being performed behind a lane closure on the opposite side of the travel way.

C. Excavations

During foundation excavations, if the excavation can not be backfilled by the end of each days operation, the contractor shall protect/shield the excavation in a method approved by the Engineer

D. Overhead Sign Installation

During Overhead Sign installations, the Contractor may stop traffic, if necessary, for the safe installation of the overhead DMS for a maximum 15 minute time period. See Roadway Standard Drawing 1101.02, sheet 1/9

1.4 MEASUREMENT AND PAYMENT

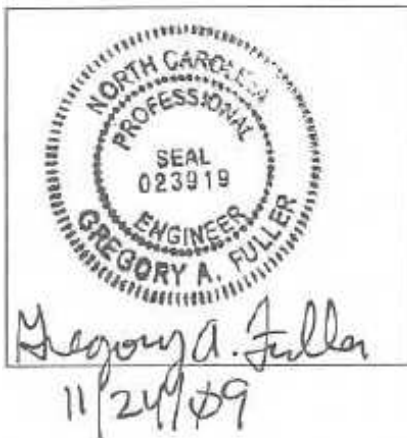
All work involved under this section shall be incidental to the other work items in the project.



John S. Kite Jr.
10/22/09

NC 58 (B. CAMERON LANGSTON BRIDGE) ADVANCED QUEUE DETECTION WARNING SYSTEM

Project Special Provisions Intelligent Transportation Systems



Prepared By:
Ian N. Avery
Heidi Bergeron
Mohd Aslam, P.E.

24-Nov-09

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1. PROJECT OVERVIEW

1.1 GENERAL DESCRIPTION

This project consists of furnishing, installing, testing, and integrating an Advanced Queue Detection Warning System in Carteret County, along NC 58 on both sides of the "B. Cameron Langston Bridge" crossing the Atlantic Intracoastal Waterway providing access between Emerald Isle and Cape Carteret.

The project will consist of using Microwave Vehicle Detection (MVD) technology (Multiple Units) to detect traffic data (presence, speed, volume, occupancy). The traffic data from the MVD units will be sent to an on-site Event Processor located in one of the Dynamic Message Signs (DMS) that will in turn analyze the traffic data and relay a contact closure output to the appropriate to display predetermined messages stored in the DMS's controller data base.

1.2 COMMUNICATIONS MEDIA

Communications between the MVD units and the Event Processor will be by RS232/485 serial connection or by spread spectrum radios operating in the 900MHz license free band. Ensure the 900MHz spread spectrum radios are an integral part of the MVD Assembly. The Event Processor will communicate with the DMS signs via its contact closure outputs which will either be hardwired to the DMS or to a contact closure radio which will communicate with another DMS.

Conduct wireless signal strength field surveys at each proposed wireless device location. Should repeater locations be necessary to establish optimal signal strength locate these devices as necessary. With the Engineer's Approval, adjust final locations of these field devices to achieve optimal communications signal strengths throughout the system. A 98% success rate with a minimum of 1,000 uninterrupted polls will be considered acceptable when performing the "Data Integrity" field tests to determine optimal signal strength throughput acceptance. Submit the results of the wireless signal strength surveys for approval before beginning device installations.

1.3 DIVISION 2 – TRAFFIC MANAGEMENT CENTER

Provide a dialup telephone connection link between the Division 2 - Traffic Management Center located at 1704 North Greene Street in Greenville, NC, and the Dynamic Message Signs and Event Processor.

Furnish and install equipment and software required to retrieve traffic data, manipulate sign messages, and update the Event Processor software from the Division 2 - Traffic Management Center as required by these Project Special Provisions and to integrate these components into a complete and operational system. Prior to performing any work at the Division 2 - Traffic Management Center make arrangements with the Division 2 - Division Traffic Engineer at (252) 830-3490 to gain access to the facility.

2. 2006 STANDARD SPECIFICATIONS FOR ROADS & STRUCTURES

The 2006 Standard Specifications are revised as follows:

2.1 GENERAL REQUIREMENTS (1098-1)

Page 10-268, Sub article 1098-1(H)

In the second paragraph, add "Use 200 amp meter base for underground electrical service."

2.2 WOOD POLES (1098-6)

Page 10-272, Delete article. Refer to Sub articles 1082-3(F) and 1082-4(G).

2.3 UNDERGROUND CONDUIT-CONSTRUCTION METHODS (1715-3)

Page 17-10, Sub article 1715-3(B) Section (1), Revise 1st paragraph, 2nd sentence to:

Install rigid metallic conduit for all underground runs located inside railroad right-of-way.

3. GENERAL REQUIREMENTS

3.1 MATERIALS

A. General

Conform to these Project Special Provisions and the 2006 Standard Specifications for Roads and Structures (also referred to herein as the "Standard Specifications"). The current edition of these specifications and publications in effect on the date of advertisement shall apply.

Conform to the requirements of the pay items included in these Project Special Provisions. All other pay items **NOT** listed in these Project Special Provisions are included in the Standard Specifications. Conform to the Standard Specifications for any pay item not included as part of these Project Special Provisions but are described in the Standard Specifications, unless modified herein.

Unless otherwise stated, furnish new equipment, materials, and hardware that meet the requirements of these Project Special Provisions. Permanently inscribe the manufacturer's name, model number, serial number, and any additional information needed for proper identification on each piece of equipment housed in a case or housing. Ensure all materials are compatible with the existing equipment as specified in these Project Special Provisions.

B. Qualified Products List

The Department has a Qualified Products List (QPL) available for the contractor's use. The QPL web site is:

<http://www.ncdot.org/doh/preconstruct/traffic/ITSS/SMS/qpl/>

C. Submittal Requirements

Before beginning installation of any component, submit manufacturer's specifications, catalog cut sheets, system block diagrams, and / or wiring diagrams (as applicable) for each proposed piece of equipment. The Engineer will return submittals with comments to the Contractor within forty (40) days. Once materials have been approved, the Contractor may begin installation. Provide three (3) copies of each submittal for review. Sixty (60) days prior to system testing provide Engineer with an installation test plan outlining test procedures and test reports.

Submit the following items for information purposes only:

- Manufacturer's warranty information on all devices furnished with each device subsystem.
- Furnish all manuals (user's guides, owners' manuals, etc.) furnished by the manufacturer for all devices used in each device subsystem.
- All software to be furnished on the project with associated user's/setup manuals.

D. Warranties

Ensure all equipment and workmanship supplied is fully warranted. Unless otherwise required herein, provide manufacturer's warranties on all Contractor-furnished equipment for material and workmanship that are customarily issued by the equipment manufacturer and that are at least one (1) year in length from the completion of the 30-day Observation Period. Include unconditional coverage for all parts and labor necessary or incidental to the repair of defective equipment or workmanship and malfunctions that arise during the warranty period. Ensure that all Contractor-

furnished equipment, including hardware, firmware, software, middle-ware, internal components, and subroutines which perform any date or time data recognition function, calculation, or sequencing will support a four-digit year format for a period of at least 50 years.

Upon successful completion of the 30-day Observation Period, and Final Acceptance of the project, transfer all manufacturers' warranties with proper validation by the manufacturer to the Department or its designated maintaining agency.

E. Firmware Licensing and Upgrades

Provide the Department with an unlimited license to duplicate all central programs and remote site programs to facilitate the addition of future sites throughout North Carolina. Provide three (3) copies of all software packages on CD-ROM.

Ensure software and firmware performance upgrades that occur during the warranty period are available to the Department at no additional cost.

F. Documentation

Except for standard bound manuals, bind all 8.5 x 11 inch documentation, including 11 x 17 inch drawings folded to 8.5 x 11 inch, in logical groupings in loose-leaf binders. Use either the 3-ring or the plastic slide-ring type binders. Permanently label each such bound grouping of documentation.

For documentation that exceeds 8.5 x 11 inch, furnish good quality, highly legible, reproducible drawings; however, the use of 11 x 17 inch drawings folded and bound into manuals will be acceptable.

Provide three (3) Operators' Manuals containing detailed operating instructions for all contractor-furnished equipment. Ensure manuals contain instructions for possible modification of equipment within the capability of equipment. Ensure personnel who have a clear understanding of system operation, system components, maintenance, troubleshooting, and expansion write the manuals.

Provide three (3) Maintenance Procedure manuals containing detailed preventive and corrective maintenance procedures for each type or model of equipment. Provide detailed wiring diagrams that include interconnection of equipment with pin-out configurations, pin functions, and cable parts numbers. Provide three (3) copies of the system connection diagrams showing system interconnection cables and associated terminations.

Provide detailed reproducible wiring diagrams that include interconnection of equipment with pin-out configurations, pin functions, and cable part numbers.

Provide wiring diagrams for each location in which new equipment is installed or wiring /cabling configurations are modified.

Provide real world coordinates for all field devices (including but not limited to, DMS and their structures, MVD units, stand-alone repeater sites, junction boxes) installed and / or modified under this project. Provide the coordinates in feet units using the North Carolina State Plane coordinate system (1983 North American Datum also known as NAD '83). Furnish coordinates that do not deviate more than 1.7 feet in the horizontal plane and 3.3 feet in the vertical plane. Global positioning system (GPS) equipment able to obtain the coordinate data within these tolerances may be used. For equipment cabinets, obtain and provide the location of the cabinet.

Provide both a digital and hard copy of all information regarding the location (including but not limited to manufacturer, and model number) in the Microsoft spreadsheet provided by the Department, shown by example below.

Name	Location	Lat.	Long.	Manufacturer	Model #	Comm Media	Destination
HUB Controller CCTV 1	I-40 MMNC 58 MM128	-78.8123	35.8625	Pelco	Spectra III	Wireless Serial RS 232/485	DMS SIGN 1TRTMC
MVD Unit 1CCTV 2	I-40NC 58 MM 132	-78.8523	35.8523	Pelco	Spectra III	Wireless	TRTMC DMS Sign 2
MVD Unit 2CCTV 3	NC 58 I-40 MM 135	-77.925	35.2456	Pelco	Spectra III	Wireless	TRTMC

3.2 CONSTRUCTION METHODS

A. General

Unless otherwise stated in these Project Special Provisions, perform work that meets the requirements of the Standard Specifications and these Project Special Provisions. In the event of a conflict between these Project Special Provisions and the Standard Specifications, these Project Special Provisions shall govern.

Immediately cease work and notify the Engineer and the affected owners if damage to existing utilities, cables, or equipment occurs. Make all required repairs and replacements at no additional cost to the Department.

Field inspect all S-Dimensions provided in the plans for proposed DMS and MVD locations to ensure accuracy with respect to the final placement of these structures. Any adjustments concerning final placement of these structures will be incidental to the installations of the structure and no separate payment will be made for this work.

B. Regulations and Codes

Furnish material and workmanship conforming to the National Electric Code (NEC), the National Electric Safety Code (NESC), Underwriter's Laboratories (UL) or other listing agencies approved by the North Carolina Department of Insurance and all local safety codes in effect on the date of advertisement. Comply with Article 4, Chapter 87 of the North Carolina General Statutes (Licensing of Electrical Contractors). Comply with the Plans, all previously referenced specifications, and all applicable local ordinances and regulations before and during all stages of electrical work.

When required by the local ordinances and governmental agencies, upon completion of the work, have all systems inspected and approved in writing by the authorized governmental electrical inspector for the area. Furnish written certification of the authorized inspector's approval to the Engineer. Inspection by the authorized governmental electrical inspector must neither eliminate nor take the place of inspections by the Engineer. Upon the Engineer's receipt of written certification and the Contractor's written request for a final inspection of the installations, the Engineer will perform a final inspection.

4. ELECTRICAL SERVICE

4.1 DESCRIPTION

Install new electrical service equipment as shown in the plans. The first item of work on this project is the installation of all electrical service poles and meter base/disconnect combination panels to expedite the power service connections. Comply with the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the NCDOT 2006 Standard Specifications, the Project Special Provisions and all local ordinances. Coordinate all work involving electrical service with the appropriate utility company and the Division 2 – Division Traffic Engineer or his designated representative.

It is the Contractor's responsibility to apply and pay for all fees associated with any electrical permits and inspections required by the local utilities. The Department will apply for electrical service in the Department's name and be responsible for any monthly fees associated with the electrical service. No contract time extensions will be granted for delays associated with installing new electrical service.

4.2 MATERIAL

A. Meter Base/Disconnect Combination Panel

Furnish and install new Meter Base/Disconnect Combination Panels at locations shown in the Plans. Ensure Meter Base/Disconnect Combination Panels are listed as meeting UL Standard UL-67 and marked as being suitable for use as service equipment. Fabricate enclosure from galvanized steel and electrostatically apply dry powder paint finish, light gray in color, to yield a minimum thickness of 2.4 mils. Provide ground bus and neutral bus with a minimum of four terminals with minimum wire capacity range of number 14 through number 4 AWG.

Furnish a NEMA Type 3R, 100 Ampere rated meter base/disconnect combination panel with a minimum of 4 spaces for all electrical services. Furnish a 4 terminal, 600 volt, single phase, 3 wire meter base that complies with the following:

- Line, Load, and Neutral Terminals accept #6 to 2/0 AWG Copper/Aluminum wire
- Ringless Type without bypass
- Made of galvanized steel
- Meet the UL-414 standard
- Overhead and underground service entrance
- For underground electrical service installations ensure the meter base/disconnect combination panel is designed such that the service entrance conductors and the load side of the panel are separated from each other via a continuous metal raceway.

For DMS Cabinet installations furnish as the main disconnect a double pole 50-ampere circuit breaker with a minimum of 10,000 RMS symmetrical amperes short circuit current rating.

B. 2" Conduit Stub-Out for Underground Electrical Service

Furnish a 2-inch rigid galvanized steel conduit stub-out for the underground service entrance conductors as shown on the Plans. For installations where the electrical service will be supplied from underground, furnish a 6" X 6" treated wood post to serve as the support to attach the conduits and electrical service equipment.

C. DMS Cabinet Feeder Conductors—4-Wire, #8 THWN Stranded Copper

Furnish four (4) #8 AWG stranded copper feeder conductors with THWN rating to supply power to the DMS cabinet. Provide the #8 AWG conductors with, red, black, white and green insulation intended for power circuits at 600 Volts or less and comply with the following:

Listed as meeting UL Standard UL-83
Meets ASTM B-3 and B-8 or B-787 standards.

4.3 CONSTRUCTION METHODS

A. Meter Base/Disconnect Combination Panel

At locations where new electrical service is required, furnish and install electrical service as called for in the Plans. Ground the new electrical service in accordance with the Standard Specifications and Standard Drawings.

Route the feeder conductors from the meter base/disconnect combination panel to the equipment cabinet or supplemental equipment cabinet disconnect. The supplemental equipment cabinet disconnect is required when the meter base disconnect and the equipment cabinet are not co-located within a reasonable distance from one another. If the equipment cabinet and the meter base disconnect are not within sight or an individual would need to cross obstructions (roadway, ditches, etc.) to shut power off to the cabinet then a supplemental equipment cabinet disconnect is required.

Ensure that the grounding system complies with the grounding requirements of these Project Special Provisions, the Standard Specifications and the Plans.

Permanently label all cables at all access points. Stamp or engrave label identifications on metal tags, or neatly and legibly lettered with permanent ink on nylon tags. Provide a unique label identifier for each cable and label each cable immediately upon installation. Use component name and labeling scheme approved by the Engineer.

B. 2" Conduit Stub-Out for Underground Electrical Service

At locations with an underground electrical service entrance, furnish and install a 2-inch rigid galvanized steel conduit stub-out for the underground service entrance conductors. The 2-inch stub out will extend from the meter base/disconnect combination panel to 18 inches below the ground surface. Provide a rigid metallic sweeping 90-degree elbow to transition from the vertical segment to a horizontal position. Cap the end of the 90-degree sweeping elbow with a plastic cap. Bond the

conduit to the ground bus inside the meter base/disconnect combination panel in accordance with the NEC.

C. DMS Cabinet Feeder Conductors– 4 Wire THWN #8 AWG Stranded Copper

At locations shown in the Plans install four (4)#8 AWG stranded copper feeder conductors to supply the 120/240 Volt AC to the DMS cabinet. Ensure in the equipment cabinet and/or supplemental equipment cabinet disconnect that the neutral bus and ground bus are isolated.

4.4 MEASUREMENT AND PAYMENT

Meter Base/Disconnect Combination Panel will be measured and paid as the actual number of complete and functional meter base/disconnect combination panel service locations furnished, installed and accepted. This item will include the appropriately sized/quantity service entrance conductors between the meter socket and corresponding breakers, mounting posts and mounting hardware, exposed vertical conduit runs to the cabinet, ground rods, ground wire and any remaining hardware and conduit to connect the electrical service to the cabinet will be considered incidental to the meter base/disconnect combination panel. The 6" X 6" treated wood post will be considered incidental to the meter base/disconnect combination panel.

2" Conduit Stub-Out for Underground Electrical Service will be measured and paid as the actual number of 2" conduit stub-out for electrical service entrances furnished, installed and accepted.

DMS Feeder Conductor– 4-Wire THWN #8 AWG Stranded Copper will be measured and paid as the actual linear feet of 4-wire #8 AWG copper feeder conductors furnished, installed and accepted. Payment is for all three conductors. Measurement will be for the actual linear footage of combined conductors after all terminations are complete. No separate payment will be made for each individual conductor. No payment will be made for excess wire in the cabinets.

Payment will be made under:

Pay Item	Pay Unit
Meter Base/Disconnect Combination Panel.....	Each
2" Conduit Stub-Out for Underground Electrical Service.....	Each
DMS Feeder Conductors 4-Wire THWN #8 AWG Stranded Copper.....	Linear Feet

5. PHONE SERVICE

5.1 DESCRIPTION

Install new phone service including modems with surge protection hardware at locations shown in the plans. Comply with the National Electric Code (NEC), the National Electrical Safety Code (NESC), the NCDOT 2006 Standard Specifications, the Project Special Provisions and all local ordinances. All work involving phone service shall be coordinated with the Phone Company.

Coordinate with Phone Company to ascertain the practicality of installing the phone service at

each location before performing any work.

5.2 MATERIALS

A. General

Furnish new demarcation box including 1" riser with Weatherheads and 1" conduit for entrance of the phone service conductors. Furnish phone type wire intended for use in wet locations.

Furnish an industrial grade modem with a data rate of 56 kbps. Ensure the modem will automatically reset itself in the event of a hardware or software problem. Provide phone line surge and lightning protectors that are UL rated for industrial use and meet the following specifications:

Technology	Solid state with fast acting fuses and resistors
Usage	Telephone Line
Ports Protected	1 (2 lines per port)
Connectors	RJ11/12
Surge Capacity	1.9 kA / line
Clamp & Rated Voltage	270 V and 200 V
Max Frequency	50 MHz
Operating Temperature	-40° F to 185° F
Max Inline Resistance	22 Ohms
Ratings	UL 497A, IEC801-5, CCITT (ITU-T) K17

5.3 CONSTRUCTION METHODS

A. Phone Service

At locations where new phone service is required, coordinate with the local phone company, provide all required equipment, hardware, demarcation box, wires, cable, conduits, poles, and etc. for successful delivery, installation, connection, and activation of the service. Connect the phone service grounding conductor to the main electrical service grounding conductor.

Install the modem and interface with the phone line surge and lightning protection device and make operational.

5.4 MEASUREMENT AND PAYMENT

The actual number of *Phone Service(s)* furnished, installed and accepted. Riser assemblies, underground and exposed conduit runs to the cabinet, demarcation box, modems, surge protection devices, wires, service hookup and acquisition costs, ground wire and any remaining hardware and

conduit to connect the phone service to the cabinet will be considered incidental to the phone service.

Payment will be made under:

Phone Service Each

6. MICROWAVE VEHICLE DETECTOR (MVD)

6.1 DESCRIPTION

Furnish new non-intrusive pole-mounted microwave/radar vehicle detectors (MVD) with mounting hardware in accordance with the Plans and these Project Special Provisions. Ensure the MVD unit functions as a wireless, out-of-pavement, queue detection device which can provide presence, volume, lane occupancy, speed, and vehicle classification information for up to 12 separate lanes, up to 250 feet away. Ensure the MVD unit is fully programmable to support multiple applications using simple intuitive software on a Notebook PC.

6.2 MATERIALS

A. Microwave Vehicle Detector (MVD)

Ensure the MVD unit functions as a true presence detector and is suitable for mounting on poles located beside the roadway, or along overhead structure supports. Ensure the unit provides presence detection of moving and/or stopped vehicles through emulation of single or dual induction loop configurations. Furnish units that can identify vehicle data on a per lane basis with regards to class and length of vehicle. Ensure the units can transmit its data either through hardwired connections to the Event Processor or via a built-in wireless serial interface operating in the 900 MHZ frequency range.

Ensure the MVD unit is reliable in all weather conditions and enclosed in a water tight enclosure. Ensure the MVD unit supports various built-in communications options including RS 232/485 hardwire interface and/or an internal 900 MHz spread spectrum radio modem.

Ensure the units are designed to prevent reversed assembly or improper installation of connectors, fasteners, etc. to guard against over, under and wrong polarity of applied voltage. Ensure equipment is designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

Ensure the MVD unit meets the following minimum functional requirements:

Radar Detection

- Radar detector for vehicle detection operates in 24GHz band
- Area Coverage Field of view defined by:
 Elevation Beam Width: 50°

	Azimuth: Beam Width 12°
	Range: 0-250 feet
• Measured Quantities	Volume, speed, occupancy, classification
• Detection Zone (lanes)	Up to 12 traffic lanes
• Range (Increment)	1.3 feet (User Defined)
• Zone Width	7-20 feet

Interfaces

- Single MS crimp multi-pin connector providing multiple options of power and communication signals.
- Optional 16 built-in isolated contact pairs rated for 100mA at 350 volts AC for presence indication.
- Isolated RS-232 / RS-485 port provide per vehicle measurement data, presence event data or statistical data.
- NTCIP 1209 protocol option.
- Built-in wireless serial radio operating at 900MHz with external antenna for data transmission to the Event Processor or hardwire connection to the Event Processor.
- Standard 8Mb built-in memory for data collection.
- Optional second port or TCP/IP-UDP interface.
- Traffic data accumulated over user defined time intervals in a 10 to 900 sec range, transmitted via serial communications lines or wirelessly to the event processor.

Mechanical

- Enclosed in NEMA 4X IP-65 polycarbonate water tight cabinet.
- Mounting bracket with locking mechanism to accommodate tilting in both axes.
- Ensure the mounting assembly is manufactured from either stainless steel, or aluminum, and can support a load of 20 pounds
- Weight, not including mounting hardware, not to exceed 10 lbs.

Power

- 3 Watts at 12 – 24 volt AC or DC with plug type transformers, 95 - 135 VAC @ 60 H
- Power surge of 1kV surge (rise time = 1.2 .sec, hold = 50µsec) applied in differential mode to all lines, power and output, as defined by IEC 1000-4-5 and EN 61000-4-5 standards

Environmental

- Temperature Range -40° to 167° Fahrenheit (95% Relative Humidity)
- Vibration = 0.5 to 30 Hz
- Shock of 10g at 11 msec. half sine wave
- Wind Loads of not less than 130 MPH

Error Tolerances

Ensure the MVD unit identifies vehicle presence within each detection zone with a 95% accuracy or greater, independent of the vehicle's direction of travel through the detection zone during normal traffic flow and when truck traffic is 10% or less. Ensure the following error levels are achievable.

Furnish the MVD unit equipped with the following features:

<u>MVD Detection</u>	<u>Sidified Error</u>
Presence	±5%
Volume	±5%
Lane Occupancy	±5%
Average Speed	±10%
Per Vehicle Speed	±10%
Length Classification	±10%
Time Event	1.3mS
Input Voltage	± 2 %

- Allow the user to define the contents of transmitted data
- Built-in non-volatile flash memory of no less than 8 Mb for storing collected time-stamped data and mechanism for remote data retrieval
- Provide fail-safe indication by contact closure
- Allow local or remote upgrade capability of its internal firmware

B. Composite Power/Serial Communications Cable

Furnish a composite power and serial communications cable that provides power connections and serial communications (RS-232/485) wiring all manufactured into one cable. Furnish cables manufactured with multiple twisted pair/stranded copper conductors (AWG #20 or #22) that are shielded to prevent crosstalk. Ensure the shield is rated for 300 volts. Ensure the completed cable assembly is suitable for installation in both a wet location and is UV protected for exposure to sunlight. Ensure the cable complies with EIA requirements as detailed in the EIA-232/422/485 standards.

C. MVD Software

Provide user friendly software to allow for programming of operational modes, detection zones and other calibration and set up parameters to be performed using a MS-Windows based software and a Notebook PC. Ensure the software allows for both manual and automatic lane configuration and verification of correct setup, and diagnostics. Provide software that is capable of saving verification data and collected traffic data, as well as, saving and retrieving sensor setup from disk file. Provide software that stores up to 8MB of data including speed, volume, occupancy, headway, and vehicle classification.

Provide MVD software licenses for use by the department and by any other agency responsible for maintaining or operating the microwave detection system. Provide the Department with a license to duplicate and distribute the software as necessary for design, maintenance, and emergency repairs.

6.3 CONSTRUCTION METHODS

A. Microwave Vehicle Detector

Install the MVD unit at the height recommended by the manufacturer, in order to minimize the masking of vehicles so that all detection zones are contained within the specified elevation angle as suggested by the manufacturer. Install conduit and fittings to supply power and/or communications raceways between the MVD and Event Processor.

Connect the MVD units to the Event Processor as shown in the plans through either hardwired connections or via its internal 900 MHz wireless radio. Set up program parameters as required to make the system functional and operational.

Test and verify the mounting height and location of each MVD unit to ensure proper/accurate detection of both North Bound and South Bound traffic flow along NC 58 prior to final installation.

6.4 MEASUREMENT AND PAYMENT

Actual number of *Microwave Vehicle Detector Unit(s)* furnished, installed, integrated, and accepted. Payment for this item will include attachment of the MVD to the DMS Structure, grounding equipment, surge protectors, conduit, connectors and raceways, noise filters, and all other equipment, testing and labor required to furnish a completed assembly. No separate payment will be made for software configuration required to install the MVD unit and integrate with the system.

Actual number of *Microwave Vehicle Detector Unit with Internal Radio* assemblies furnished, installed, integrated, and accepted. Payment for this item will include attachment of the MVD to the DMS Structure, the addition of the 900 MHz serial radio, site testing, "Data Integrity" radio field testing, coaxial cable, surge protection, conduit, connectors and raceways, antenna mounting hardware, antennas, coaxial cable shield grounding hardware, and all other items, equipment, and labor required to furnish a completed assembly. No separate payment will be made for software configuration required to install the MVD unit and integrate with the system.

Actual linear feet of *Composite Power/Serial Communications Cable* furnished, installed and accepted. Payment will include all labor associated with installing and terminating the cable and its assemblies.

Payment will be made under:

Pay Item	Pay Unit
Microwave Vehicle Detector Unit.....	Each
Microwave Vehicle Detector Unit with Internal Radio.....	Each
Composite Power/Serial Communications Cable.....	Linear Feet

7. EVENT PROCESSOR

7.1 DESCRIPTION

A. General Requirements

Furnish and install an Event Processor in accordance with the Plans and these Project Special Provisions. Provide an Event Processor that has a shelf mount design and that comes complete with software that runs on a PC or Notebook Computer.

Ensure the Event Processor's Software provides for the programming of command parameters and event definitions. Ensure the system can record and upload event functions to the PC or Notebook computer at the project site and via a dial-up phone connection over a 56k baud modem. Ensure the software is password protected.

The two separate MVD units provided for this system will detect two lanes of traffic flowing in opposite directions. The MVD units will be located on opposite ends of the NC 58 Bridge in Cape Carteret, NC and will be installed approximately 1 mile apart. The system will select one of the following messages to display on the appropriate DMS sign based on the traffic data the Event Processor receives from both MVD units.

HIGH PRIORITY = Stopped Traffic Ahead

LOW PRIORITY = Slow Moving Traffic Ahead

(The selection of either the *Higher* or *Lower* priority message will be determined using user selectable threshold parameters associated with vehicle speeds and lane occupancy).

MVD Unit #1 and MVD Unit #2 shall continue to poll *both* travel lanes and send data over a user selectable "data collection period" to the Event Processor to evaluate if conditions exist at either DMS location to necessitate turning on a message. Once conditions exist in either lane of traffic, at one or both DMS locations, to necessitate turning on a message, the event processor shall send a contact closure signal to the appropriate sign location.

In addition to displaying the appropriate DMS message, ensure that the software allows the user to select the amount of time allotted for the "data collection period". The time out function, the minimum amount of time to display the message even after the condition has terminated, shall be user selectable as "X" number of "data collection periods". Also, ensure the software does not drop the contact closure at the end of a timeout function, if the condition is still present. Ensure the software has user programmable features that based on vehicle speed and lane occupancy will allow the appropriate priority message to be displayed.

Interface the Event Processor at Master location with the following:

- 1) 900 MHz Wireless Contact Closure Radio for communication with the Remote Located DMS.
- 2) 900 MHz Wireless Serial Radio for communication with MVD Unit #2 at the remote location.
- 3) Hardwired connection to MVD Unit #1 at the Master location.
- 4) Hardwired connection to the DMS at the Master location.

House the Event Processor, Wireless Contact Closure Radio and Wireless 900 MHz Serial Radio in the DMS Controller Cabinet.

B. 900 MHz Wireless Contact Closure Radio

Provide a contact closure radio system to provide the communications link between the Event Processor and the DMS sign located on the south side of the NC 58 Bridge. Provide a contact closure wireless system with a bi-directional, full duplex communications channel between two "line-of-sight" antennas using license free, spread spectrum technology operating in the 902-928 MHz frequency band.

Furnish material and workmanship conforming to the National Electrical Code (NEC), the National Electrical Safety Code (NESC), Underwriter's Laboratories (UL) or a third-party listing agency accredited by the North Carolina Department of Insurance, and all local safety codes in effect on the date of advertisement.

C. 900 MHz Serial Radio

Provide a 900 MHz spread spectrum radio to provide the communications link between the Event Processor and the remote MVD unit located on the south side of the NC 58 Bridge. Provide a serial radio system with a bi-directional, full duplex communications channel between two "line-of-sight" antennas using license free, spread spectrum technology operating in the 902-928 MHz frequency band.

Furnish material and workmanship conforming to the National Electrical Code (NEC), the National Electrical Safety Code (NESC), Underwriter's Laboratories (UL) or a third-party listing agency accredited by the North Carolina Department of Insurance, and all local safety codes in effect on the date of advertisement.

7.2 MATERIALS

A. Event Processor

Provide a fully programmable shelf mount Event Processor unit capable of processing data from up to 8 MVD stations. Ensure that the Event Processor is capable of monitoring up to 16 pre-defined Complex Boolean events using up to 4 parameter-limit conditions. Ensure that based on these preprogrammed parameter-limit conditions the Event Processor will send a contact closure output to the appropriate DMS. Ensure the Event Processor's software allows for a programmable response delay.

Ensure the unit has two communication ports that will allow the Event Processor to interface with a Notebook Computer and the MVD units. Ensure the Event Processor has a minimum of 2 Mb of data storage capability.

Ensure the Event Processor can receive data from a locally hardwired MVD connected to its serial communications port. Additionally ensure the Event Processor can receive data from other MVD units over a wireless link connected to the same serial port using a Y-Type serial cable.

Ensure the Event Processor supports a minimum of eight (8) Open Collector contact closure output pairs rated at 30 VDC, 5A, polarity sensitive. Ensure that the contact closure output remains in effect as long as the condition persists incorporating a preprogrammed delay if desired.

Ensure the Event Processor meets the minimum Environmental Conditions:

Temperature Range	-35° to 165°F
Power	12V DC or AC
Power Consumption	0.5 watts (Standalone)
Humidity	95% Relative Humidity
Vibration	2g up to 200Hz sinusoidal
Shock	5g 10 ms half sine wave

Provide the Event Processor with set up software that allows for various communications options with the MYD stations as well as dialup exchange with the Division 2 – Traffic Management Center. Ensure the set up software is user friendly and provides event definitions using simple tables along with remote or local event status, data and diagnostic display, etc. Ensure the Event Processor system has a fail safe design for power failure by opening the contact closure output during a power failure.

B. 900MHz Contact Closure Radio

Furnish a spread spectrum contact closure radio modem with internal time delay capabilities designed specifically for ON/OFF applications including antennas, coaxial cable and mounting hardware, and configuration software. Design radio modems to work in "point-to-point", "point-to-multipoint", "multipoint-to-point", and "multipoint-to-multipoint" configurations. Ensure the contact closure radio modem meets the following minimum requirements:

- License free (ISM) Spread Spectrum radio band (902 – 928 MHz)
- Utilizing Frequency Hopping Technology (Direct Sequence Spread Spectrum Technology is not acceptable)
- Bi-Directional communications and the ability to confirm switch closure at the remote site
- Capable of operating as a Master, Remote/Repeater, or remote
- Programmable Radio Frequency (RF) output levels of 1mW, 10mW, 100mW, or 1 Watt
- A minimum of 128 user-selectable radio frequency channels, with 64 available hopping sequences (2 non-overlapping)
- 16 bit Cyclic Redundancy Check (CRC) / error checking with auto re-transmit
- Provide Forward Error Correction (FEC) as standard
- 16 Bit encryption
- Receiver Sensitivity of -113 dBm @ 10⁻⁶ BER
- Programming Port: RJ12
- Antenna Port: Reverse Polarity - Threaded Normalized Connector-Female (RP TNC-F) antenna connector
- Pre-programmable timer outputs for up to two hours
- Relay Input: 0 –24VDC (ground activated)
- Relay Outputs: 8 digital open collector (Max 500ma load current per output)
- Power Requirements (Typical):
 - Wall adapter: 120 VAC UL/CSA wall cube plug-in module with 6 to 30 Volt DC output.

- Typical current draw <100 mA (standby), <125mA at 100mW output setting (during Transmit)
- Operating temperature of -40 to +165 degrees F
- Humidity: 95% Non-condensing
- Front panel LED indicators for:
 - Power/RF link status
 - Input Active per channel
 - Output Active per channel
- Shelf Mount Design

C. 900MHz Serial Radio

Furnish license free 902 – 928 MHz radio modems with antennas, coaxial cable and mounting hardware, and configuration software. Design radio modems to work in "point-to-point", "point-to-multipoint", "multipoint-to-point", and "multipoint-to-multipoint" configurations. Ensure the spread spectrum wireless radio meets the following minimum requirements:

- License free (ISM) Spread Spectrum radio band (902 – 928 MHz)
- Frequency Hopping Technology (Direct Sequence Spread Spectrum Technology is not acceptable)
- Bi-Directional, Full Duplex
- Programmable Radio Frequency (RF) output levels of 1mW, 10mW, 100mW, or 1 Watt
- A minimum of 139 user-selectable radio frequency channels, with 62 available hopping sequences (2 non-overlapping)
- RS-232 interface capable of operating from 1200 bps to 115.2 Kbps, with 8 or 9 bit format or 1200 bps Bell 202
- DB9-F connector for RS-232 port
- Maximum of 8 mSec. end-to-end latency
- 16 bit Cyclic Redundancy Check (CRC) error checking with auto re-transmit
- Built-in store-and-forward (single radio repeater – back to back radio set-ups are not allowed to accomplish this function)
- 32 Bit encryption
- Receiver Sensitivity of -110dBm @ 10^{-6} BER
- Antenna port: Reverse Polarity - Threaded Normalized Connector-Female (RP TNC-F) antenna connector
- Front panel LED indicators:
 - Power
 - Transmit Data
 - Receive Data
 - Data Port Indicator
- Operating temperature of -40 to +165 degrees F
- Humidity: 95% Non-condensing
- Power supply requirements:
 - Wall Adapter: 120 VAC UL/CSA wall cube plug-in module with 12 VDC, 1 Amp, nominal output.

- Typical current draw of no greater than 355 mA when powered with 12 VDC input, and transmitting 1 Watt of RF output power.
- Radio Sleep mode with a maximum current draw of $<1\mu\text{A}$.
- Shelf mounted design

Furnish a Radio Frequency Signal Jumper constructed of an RG-58 Coaxial Cable with Reverse Polarity - Threaded Normalized Connector-Male (RP TNC-M) on one end for connection to a radio unit and a Standard N-Type Male Connector on the other end for connection to the lightning arrestor. Provide the jumper in 6-foot lengths.

Furnish an RS-232 data interface cable to be installed between the radio modem and the field device's RS-232 interface. Ensure cable is a minimum of 6 feet long.

Ensure that installing the wireless radio system with the Event Processor unit does not require any field device modifications concerning hardware or software.

D. Other Radio Requirements

a. Software:

Furnish units with a Window Based™ software program that uses a GUI (Graphical User Interface) to provide "remote programming, radio configuration, remote maintenance, diagnostics and spectrum analyzer" features. Provide all future upgrades for configuration at no additional charge.

Ensure the radio modem is configurable from a single location (i.e. master radio location) via supplied software (no extra cost). Furnish software supplied with drivers to allow easy set-up. Furnish complete instructions for system programming.

b. Directional Antenna (Yagi):

Furnish a directional antenna that will allow the system to function as designed. Furnish an 8.5 dB Gain antenna that meets the following minimum specifications:

(8.5 dB Gain)

Frequency Range	896 – 940 MHz
Nominal Gain	8.5 dB
Front to Back Ratio	18 dB
Horizontal Beamwidth (at half power points)	65 degree
Vertical Beamwidth (at half power points)	55 degree
Power Rating, UHF Frequency	200 Watts
Lightning Protection	DC Ground
Termination	Coaxial pigtail with a Standard N-Type Female Connector
Impedance	50 ohms
Length	24"
Rated Wind Velocity	125 mph
Rated Wind Velocity (with 0.5-inch radial ice)	100 mph
Projected Wind Surface Area (flat plane equivalent)	0.26 ft sq.
Number Elements	6
Allows for Vertical or Horizontal polarization	
Minimum separation distance from persons installing and using an active device	9'
Minimum separation distance from other RF sources including radios and antennas	6.5'
Welded construction	

c. Antenna Mounting Hardware Kit:

Furnish an antenna mounting kit to support the antenna when attached to a metal pole, mast arm, or wood pole. **Furnish the following materials or an approved equivalent.**

PELCO Part # AB-0121-42	Quantity 1 1.5" Astro Mini-Bracket, Fits 4" to 12.7" Pole Diameter
PELCO Part # SE-0436-18	Quantity 2 1.5"NPS x 18" Aluminum Pipe, Threaded on both ends
PELCO Part # SE-0457	Quantity 1 Serrated 90 Degree Elbow
PELCO Part # SE-0346	Quantity 1 1.5" NPS x 2" Aluminum Notched Coupling
PELCO Part # SE-0361	Quantity 1 1.5" NPS x 7/8" Aluminum Octagonal Closure Cap

d. Coaxial Cable:

Furnish a coaxial cable to provide a link between the antenna and the lightning arrestor that meets the following minimum specifications:

Attenuation (dB per 100 feet) @ 900 MHz	3.9 dB
Power Rating @ 900 MHz	0.58 kW
Center Conductor	0.108" (2.74 mm) Copper Clad Aluminum
Dielectric: Cellular PE	0.285" (7.24 mm)
Shield	Aluminum Tape – 0.291" (7.39 mm) Tinned Copper Braid – 0.320" (8.13 mm)
Jacket	Black UV protected polyethylene
Bend Radius	1" (25.4 mm) with less than 1 ohm impedance change at bend
Impedance	50 ohms
Capacitance per foot	23.9 pF/ft
End Connectors	Standard N-Type Male Connectors on both ends

e. Standard N-Type Male Connector

Furnish Standard N-Type Male Connector(s) of proper sizing to mate with the 400 series coaxial cable and utilizes a crimping method to secure the connector to the coaxial cable. Furnish a connector that meets the following minimum specifications:

- Center Contact: Gold Plated Beryllium Copper-(spring loaded – Non-solder)
- Outer Contact: Silver Plated Brass
- Body: Silver Plated Brass
- Crimp Sleeve: Silver Plated Copper
- Dielectric: Teflon PTFE
- Water Proofing Sleeve: Adhesive Lined Polyolefin – Heat Shrink
- Attachment Size: Crimp Size 0.429" (10.89 mm) minimum hex

Electrical Properties:

- Impedance: 50 ohms
- Working Voltage: 1000 vrms (max)
- Insertion loss: $0.1 \times \sqrt{f}$ ghz
- VSWR: 1.25:1 (max) up to 3GHz

Provide instructions on properly installing the connector.

f. Coaxial Cable Shield Grounding and Weatherproofing Kits:

Furnish a Coaxial Cable Shield Grounding Kit containing components that will adequately bond and ground the cable shield to the pole ground. Ensure the grounding kit complies with MIL-STD-188-124A Specifications "Military Standard for Grounding, Bonding and Shielding" for coaxial cable and protects the cable from lightning currents in excess of 200kA. Ensure each kit is supplied, as a minimum, with the following:

- Preformed Strap: 24 Gauge copper strap that is a minimum of 1½/8-inch (41.3 mm) long and is sized to mate with the 400 series coaxial cable
- Tensioning Hardware: Copper nuts and lock washers
- Grounding Lead Cable: #6 AWG, stranded, insulated copper wire
- Instructions on properly installing the shield grounding system

Furnish a Weatherproofing Kit containing components that will protect the coaxial cable shield grounding system against the ingress of moisture and prevent vibrations from loosening the connections. Ensure the weatherproofing kit is supplied, as a minimum, with the following:

- Butyl Mastic Tape: 3¾ inches (95.25 mm) wide by 24 inches (609.6 mm) long (approximately)
- Electrical Tape: 2-inch (50.8 mm) wide by 20 inches (508 mm) long (approximately)
- Instructions on properly installing the weatherproofing system.

g. Lightning Arrestor:

Furnish a lightning arrestor installed in line between each antenna and its designated radio modem inside the equipment cabinet. Furnish a lightning arrestor that meets the following minimum specifications:

- Surge: 20kA, 800MHz to 2.0GHz $\leq 1.1 : 1$ VSWR
18kA, 800MHz to 2.3GHz $\leq 1.1 : 1$ VSWR
700MHz to 2.7GHz $\leq 1.2 : 1$ VSWR
- Insertion Loss: ≤ 0.1 dB over frequency range
- Max Power: 500 w @ 920MHz (750W @ 122°F/50°C)
- RF Power: 300 Watts
- Let Through Voltage: $\leq \pm 3$ Volts for 3kA @ 8/20 μ s Waveform
- Throughput energy: ≤ 0.5 μ J for 3kA @ 8/20 μ s Waveform
- Temperature: -40 to 185° F (-40 to 85° C) Storage/Operating 122° F (50° C)
- Vibration: 1G at 5Hz up to 100Hz
- Unit Impedance: 50 Ω
- VSWR: 1.1:1
- Frequency Range: 800 MHz to 2200 MHz
- Multistrike capability
- Low strike throughput energy
- Flange mount and bulkhead mount options
- Standard N-Type Female Connector on both the surge side and protected side connectors

7.3 CONSTRUCTION METHODS

A. General:

Install and interface the Event Processor in the DMS Master Cabinet with the Serial Radio, Contact Closure Radio, and MVD Unit #1. Additionally, interface the Event Processor's contact closure outputs with the DMS controller.

Upon installing all devices permanently mark all cables with cable number and information designating from/to units and associated connectors. Provide labels to identify the equipment as part of the Event Processor System inside the DMS cabinet. Supply power to Event Processor, and all radio equipment from an AC outlet in the DMS cabinet.

Install the Event Processor and set up the software using a Notebook PC and input initial software configurations for the Advanced Queue Detection Warning System outlined in these

Project Special Provisions. Program the Event Processor with the predefined events once approved by the Engineer. Set up software parameters for the Event Processor and dialup service as well as event notification parameters (conditions, phone number(s), etc.)

Install the Event Processor in accordance with the manufacturer's installation instructions. Install the Wireless Radio Devices in accordance with the manufacturer's installation instructions.

Perform a radio path Site Survey test before installing any wireless equipment. Ensure the test evaluates the Signal Strength (dBm), Fade Margin (dB), Signal-to-Noise Ratio, Data Integrity (poll test), and a complete frequency spectrum scan. Ensure the radio path site survey test is performed using the supplied brand of radio equipment to be deployed. A 98% success rate with a minimum of 1,000 uninterrupted polls will be considered acceptable when performing the "Data Integrity" field tests to determine optimal signal strength throughput acceptance. Provide the test results to the Engineer for review and approval. Submit copies of the test results and colored copies of the frequency spectrum scan along with an electronic copy of this information.

Mount the antenna(s) to the DMS structure by a method recommended by the manufacturer and approved by the Engineer of Record for the DMS Structure Design. Ensure the antenna(s) avoids conflicts with other utilities (separation distances in accordance with the guidelines of the National Electrical Safety Code). Secure the antenna mounting hardware to the structure and route the coaxial cable such that no strain is placed on the coaxial connectors and the cable. Route and secure the conduits and raceways to the structure in a method approved by the Engineer.

Install the coaxial cable shield grounding system by carefully removing the outer jacket of the coaxial cable without damaging the cable shield. Install the shield grounding system following the cable manufacturer recommendations. Install and make weatherproof the connection using the appropriate weatherproofing materials and following the manufacturer's recommendations. On metal poles, secure the #6 AWG grounding lead cable to the pole using an Engineer approved method.

Do not exceed the 1-inch (25-mm) bend radius of the coaxial cable as it traverses from the device to the antenna assembly. Connect the lightning arrestor to the coaxial cable in the equipment cabinet. Properly ground and secure the arrestor in the cabinet. Permanently label all cables entering the cabinet. Ensure that the power supply for the radio unit is **NOT** connected to the GFCI receptacle circuit located in the cabinet. Place a copy of all manufacturer equipment specifications and instruction and maintenance manuals in the equipment cabinet.

Perform diagnostic test to ensure that all communications channels are functional between the Event Processor and the MVD units, and Event Processor and the DMS signs.

7.4 MEASUREMENT AND PAYMENT

Actual number of *Event Processor(s)* furnished, installed, and accepted. This item includes all wiring, cabling, and hardware and software necessary to install and program the Event Processor and interface the device with other equipment. The quantity of Event Processors, measured as provided above, will be paid for at the contract unit price each for "*Event Processor*".

Actual number of *900MHz Contact Closure Radio(s)* furnished install and accepted. This item includes the appropriate sized antenna(s), coaxial cable, coaxial cable shield grounding system with weatherproofing, lightning arrestor, labeling and mounting hardware, conduit, connectors and

raceways and any integration. The quantity of 900 MHz Contact Closure Radios, measured as provided above, will be paid for at the contract unit price each for "900 MHz Contact Closure Radio".

Actual number of 900MHz Serial Radio(s) furnished installed and accepted. This item includes the appropriate sized antenna(s), coaxial cable, coaxial cable shield grounding system with weatherproofing, lightning arrestor, labeling and mounting hardware, conduit, connectors and raceways and any integration. The quantity of 900 MHz Serial Radios, measured as provided above, will be paid for at the contract unit price each for "900 MHz Serial Radio".

All power supplies, power cords, adapters, antenna mounting hardware, connectors, serial cables, installation materials and configuration software necessary to complete this work, including the radio path site survey test and warranties, will be incidental. Final payment will be made when work is accepted by the Engineer.

Payment will be made under:

Pay Item	Pay Unit
Event Processor	Each
900 MHz Contact Closure Radio.....	Each
900 MHz Serial Radio.....	Each

8. DYNAMIC MESSAGE SIGN

8.1 DESCRIPTION

Furnish and install Dynamic Message Sign systems that accept contact closure inputs from external device(s). The DMS controller will display a unique preprogrammed message on the sign in response to each input and/or combination of inputs. See Section Titled "Event Processor" for further details on these requirements.

To ensure compatibility with the existing DMS control software deployed in the region, furnish NTCIP compliant DMS's that are compatible with Daktronics Vanguard software. Add and configure the new DMS in the system using State furnished Vanguard software and computer system. Furnish, install, test, integrate and make fully operational the new DMS at location shown on the project plans.

Furnish an operating DMS system consisting of, but not limited to, the following:

- Full Matrix LED DMS capable of displaying three lines of eight 18" characters,
- DMS support structure and mounting hardware,
- DMS controller, Uninterruptible Power Supply (UPS), cabinet and accessories with interconnect and power cabling and conduit,
- Electrical and phone service and related equipment,
- All other equipment and incidentals required for furnishing, installing, and testing system and system components.

Use only UL listed and approved electronic and electrical components in the DMS system.

8.2 PREAPPROVED DYNAMIC MESSAGE SIGNS

The following DMS's are preapproved for delivery under this Project Special Provisions.

- IMAGO sign model AF0-2S2A4-1002V,
- IMAGO sign model AF0-2S2A4-0705H,
- Daktronics VF-XX VF-2420-27x60-66-A,

With the selection of a DMS from the above list, the Contractor will not be required to submit catalog cut sheets for the sign parts. The Contractor will provide shop drawings to ensure sign enclosure meets AASHTO wind requirements and structural requirement of NEMA TS4-2005 and these Project Special Provisions.

8.3 MATERIALS

A. Environmental Requirements

Construct the DMS and DMS controller-cabinet so the equipment within is protected against moisture, dust, corrosion, and vandalism.

Design the DMS system to comply with the requirements of Section 2.1 (Environmental and Operating Standards) of NEMA TS 4-2005.

Construct the DMS and housing so that it can withstand AASHTO 2002, 50-year wind speed of 130 MPH.

B. Full Matrix LED Dynamic Message Signs (DMS)

Construct the DMS to display at least three lines of text that, when installed, are clearly visible and legible to a person with 20/20 corrected vision from a distance of 900 feet in advance of the DMS at an eye height of 3.5 feet along the axis.

When displaying three lines, each line must display at least eight (8) equally spaced and equally sized alphanumeric individual characters. Each character must be at least 18 inches in height and composed from a luminous dot matrix.

1. DMS Enclosure

Construct the DMS with a metal front or rear access enclosure excluding the face. Construct the enclosure of welded aluminum type 6061-T6, 5052-H38, 5052-H34, or of an Engineer approved alternate at least 1/8-inch thick. Perform all welding of aluminum and aluminum alloys in accordance with the latest edition of AWS D1.2, Structural Welding Code - Aluminum. Continuously weld the seams using Gas Metal Arc Welding (GMAW).

Ensure the exterior and interior DMS enclosure surfaces are manufactured from natural, mill-finish aluminum. Remove all grind marks and discoloration from the surfaces.

Ensure that all nuts, bolts, washers, and other mounting and bonding parts and components used on the exterior of the DMS enclosure are corrosion resistant and sealed against water intrusion.

Furnish the sign face, excluding the front panel, with a flat black, UV treated, colorfast material. Construct UV-treated, colorfast border with a minimum width of 18 inches.

Do not place a manufacturer name, logo, or other information on the front face of the DMS or shield visible to the motorist.

Provide three photoelectric sensors installed inside the DMS enclosure-monitoring front, back, and bottom of the sign or the north sky.

Provide power supply monitoring circuitry to detect power failure in the DMS and to automatically report this fault to the Control Software. This requirement is in addition to reporting power failure at the controller cabinet.

Provide one (1) access door for each 10 to 15 pixel wide section of the sign enclosure. Vertically hinge the doors and design to swing out from the face or back to provide access to the enclosure interior. Extend each door the full height of the display matrix.

Provide a retaining latch mechanism for each door to hold the door open at a 90-degree angle.

Provide for each door a minimum of two (2) screw-type captive latches to lock them in the closed position, pull the door tight, and compress a gasket located around the perimeter of each door. Install the gasket around the doors to prevent water from entering the cabinet.

Do not paint the stainless steel bolts on the Z-bar assembly used for mounting the enclosure.

2. DMS Interior Environment Control

Install a minimum of one (1) temperature sensor that is mounted near the top of the DMS interior. The sensor(s) will measure the temperature of the air in the enclosure over a minimum range of -40°F to +176°F. Ensure the DMS controller will continuously monitor the internal temperature sensor output and report to the DMS control software upon request.

Design the DMS with enclosure ventilation system, face panel fog and frost prevention system, and safe over-temperature shutdown system.

Design the DMS ventilation system to be thermostatically controlled and to keep the internal DMS air temperature lower than +140°F, when the outdoor ambient temperature is +115°F or less.

The ventilation system will consist of two or more air intake ports located near the bottom of the DMS rear or side walls. Cover each intake port with a filter that removes airborne particles measuring 500 microns in diameter and larger. Mount one or more ball bearing-type fans at each intake port. These fans will positively pressure the DMS enclosure.

Design the fans and air filters to be removable and replaceable from inside the DMS housing. To ease serviceability, mount the fans no more than four (4) feet from the floor of the DMS enclosure.

The ventilation system will move air across the rear of the LED modules in a manner such that heat is dissipated from the LED's. Design the airflow system to move air from the bottom of the enclosure towards the top to work with natural convection to move heat away from the modules.

Install each exhaust port near the top of the rear DMS wall. Provide one exhaust port for each air intake port. Screen all exhaust port openings to prevent the entrance of insects and small animals.

Cover each air intake and exhaust port with an aluminum hood attached to the rear wall of the DMS. Thoroughly seal all intakes and exhaust hoods to prevent water from entering the DMS.

Provide a thermostat near the top of the DMS interior to control the activation of the ventilation system.

The DMS shall automatically shut down the LED modules to prevent damaging the LEDs if the measured internal enclosure air temperature exceeds a maximum threshold temperature. The threshold temperature shall be configurable and shall have a default factory setting of 140°F.

3. Face Panel

Provide each DMS with a single or multiple face panels made of 1/8-inch thick polycarbonate sheet to cover all of the pixels. Design the face panels to provide a high-contrast background for the DMS display matrix. Provide an aluminum mask painted black and to contain an opening for each pixel or an approved alternate. Design the openings to be large enough not to block any portion of the viewing cones of the LEDs. Install the mask or the approved alternate on the outside of the face panel.

The polycarbonate will be sealed to prevent water and other elements from entering the DMS. Provide polycarbonate sheets that contain UV inhibitors to protect the LED display matrix from the effects of ultraviolet light exposure and prevent premature aging of the polycarbonate itself. Provide polycarbonate sheets with the following characteristics:

- Tensile Strength, Ultimate: 10,000 PSI
- Tensile Strength, Yield: 9,300 PSI
- Tensile Strain at Break: 125%
- Tensile Modulus: 330,000 PSI
- Flexural Modulus: 330,000 PSI
- Impact Strength, Izod (1/8", notched): 17 ft-lbs/inch of notch
- Rockwell Hardness: M75, R118
- Heat Deflection Temperature Under Load: 264 PSI at 270F and 66 PSI at 288F
- Coefficient of Thermal Expansion: 3.9×10^{-5} in/in/F
- Specific Heat: 0.30 BTU/lb/F
- Initial Light Transmittance: 85% minimum
- Change in Light Transmittance, 3 years exposure in a Southern latitude: 3%
- Change in Yellowness Index, 3 years exposure in a Southern latitude: less than 5%

Mount the LED display modules to the inside of the DMS front face panels. Ensure common hand tools can be used for removal and replacement.

Paint black the DMS front face borders (top, bottom, left side, and right side), which surround the front face panels and LED display matrix to maximize display contrast and legibility.

In the presence of wind, the DMS front face shall not distort in a manner that adversely affects LED message legibility.

4. Display Modules

Manufacture each display module with a standard number of pixels that can be easily removed. Assemble the modules onto the DMS assembly contiguously to form a continuous matrix to display the required number of lines, characters, and character height.

Design display modules that are interchangeable and replaceable without using special tools. Ensure that all power and communication cables connected to a display module are of the plug-in type and allows for easy removal for maintenance and repair.

Construct each display module as a rectangular array of 5 horizontal pixels by 7 to 9 vertical pixels. Provide the module with an equal vertical and horizontal pitch between pixels, and columns that are perpendicular to the rows (i.e., no slant). Design each module to display:

- All upper and lower case letters,
- All punctuation marks,
- All numerals 0 to 9,
- Special user-created characters.

Display letters and numerals over the complete height of the module. Optimize the LED grouping and mounting angle within a pixel for maximum readability.

5. Discrete LEDs

Provide discrete LEDs with a nominal viewing cone of 30 degrees with a half-power angle of 15 degrees measured from the longitudinal axis of the LED. Viewing cone tolerances shall be as specified in the LED manufacturer's product specifications and shall not exceed +/- 3 degrees half-power viewing angle of 30 degrees.

Provide LEDs that are untinted, non-diffused, high output solid state lamps utilizing indium gallium aluminum phosphide (InGaAlP) technology manufactured by Toshiba or Hewlett-Packard. No substitutions will be allowed. Provide T1 ¼, 0.2-inch size LEDs that emit a true amber color at a wavelength of 590 ± 5 nm.

Provide LEDs with a MTBF (Mean Time Before Failure) of at least 100,000 hours of permanent use at an operating point of 140° F or below at a specific forward current of 20mA. Discrete LED failure is defined as the point at which the LED's luminous intensity has degraded to 50% or less of its original level.

Obtain the LEDs used in the display from a single LED manufacturer that have a single part number. Obtain them from batches sorted for luminous output, where the highest luminosity LED is not more than fifty percent more luminous than the lowest luminosity LED when the LEDs are driven at the same forward current. Do not use more than two successive and overlapping batches in the LED display. **Document the procedure to be used to comply with this requirement as part of the catalog cut submittal.**

Individually mount the LEDs on circuit boards that are at least 1/16" thick in a manner that promotes cooling. Protect all exposed metal on both sides of the LED pixel board, except the power connector, from water and humidity exposure by a thorough application of acrylic conformal coating. Design the boards so bench level repairs to individual pixels, including discrete LED replacement and conformal coating repair is possible.

Operate the LED display at a low internal DC voltage not to exceed 24 Volts.

Design the LED display operating range to be -20° F to +140° F at 95% relative humidity, non-condensing.

Supply the LED manufacturer's technical specification sheet with the catalog cuts.

6. LED Power Supplies

Power the LED Display by means of multiple regulated switching DC power supplies that operate from 120 volts AC input power and have an output of 24 volts DC or less. Wire the supplies in a redundant parallel configuration that uses multiple power supplies per display. Provide the supplies with current sharing capability that allows them to provide equal amounts of current to their portion of the LED display. Provide power supplies rated such that if one supply fails the remaining supplies will be able to operate their portion of the display under full load conditions (all pixels on at maximum brightness) and at a temperature of 140° F.

Provide power supplies to operate within a minimum input voltage range of +90 to +135 volts AC and within a temperature range of -22° F to 140° F. Power supply output at 140° F must not deteriorate to less than 65% of its specified output at 70° F. Provide power supplies that are overload protected by means of circuit breakers, and that have an efficiency rating of at least 75%, a power factor rating of at least .95, and are UL listed. Provide all power supplies from the same manufacturer and with the same model number. Design the power driver circuitry to minimize power consumption.

Design the Field Controller to monitor the operational status (normal or failed) of each individual power supply and be able to display this information on the Client Computer screen.

7. LED Pixels

A pixel is defined as the smallest programmable portion of a display module that consists of a cluster of closely spaced discrete LEDs. Design each pixel to be a maximum of 2 inches in diameter.

Pixels shall be constructed with two strings of LEDs. The number of LEDs in each string shall be determined by the manufacturer to produce the candela requirement as stated herein.

Each pixel shall produce a luminous intensity of 40 Cd when driven with an LED drive current of 20 mA per string.

Power the LEDs in each pixel in strings. Use a redundant design so that the failure of an LED in one string does not affect the operation of any other string within the pixel. Provide the sign controller with the ability to detect the failure of any LED string and identify which LED string has failed. Submit a complete schematic of the LED power and driver circuits with the catalog cuts.

Protect LEDs from degradation due to sunlight via flat black louvers or a functionally equivalent methodology. Place these louvers or equivalent behind the front panel. Use a method that does not reduce the display viewing-angle below that provided by the LED. Install the louvers or equivalent in such a way as to promote cooling of the LEDs and so that they are easily removable for cleaning or maintenance.

8. Character Display

Design display modules to be easily removable without the use of tools. Position cooling fans so they do not prevent removal of an LED pixel board or driver board.

Use continuous current to drive the LEDs at the maximum brightness level. Design the light levels to be adjustable for each DMS / controller so the Engineer may set levels to match the luminance requirements at each installation site.

Design the controller to automatically detect failed LED strings or drivers and initiate a report of the event to the Control Software. Design the controller to be able to read the internal temperature of the DMS enclosure and the ambient temperature outside the DMS enclosure and report these to the Control Software.

9. Display Capabilities

Design the DMS with at least the following message displays:

- Static display
- Flashing display with Dynamic flash rates
- At least two alternating Static and / or Flashing sequences (multi-page messages)

C. DMS Enclosure Structure Mounting

Mount the DMS enclosure and interconnect system securely to supporting structures of the type specified in the Plans. Design the DMS enclosure supports and structure to allow access to the DMS enclosure access door(s).

Submit plans for the DMS enclosure, structure, mounting description and calculations to the Engineer for approval. Have such calculations and drawings approved by a Professional Engineer registered in the state of North Carolina, and bear his signature, seal, and date of acceptance.

Provide removable lifting eyes or the equivalent on the DMS enclosure rated for its total weight to facilitate handling and mounting the DMS enclosure.

Design the DMS structure to conform to the applicable requirements of the *Standard Specifications for Structural Supports for Highway Signs, Luminaries*, and the section titled "Dynamic Message Sign Structure" of these Project Special Provisions.

D. DMS/DMS Controller Interconnection

Furnish and install all necessary cabling, conduit, and terminal blocks to connect the DMS and the DMS controller. Use approved manufacturer's specifications and project plans for cable and conduit types and sizes.

E. DMS Controller and Cabinet

Furnish and install one DMS controller with accessories per DMS in a protective cabinet. Mount the controller cabinet on the DMS support structure. The controller cabinet should be CALTRANS type 336S or 332 (dependant upon manufacturers' internal components). Install cabinet so that the height to the middle of the cabinet is 4 feet.

Furnish a cabinet of sufficient size to accommodate the additional equipment required by these Project Special Provisions. Ensure the cabinet includes mounting space for the 900 MHz Serial Radio, 900 MHz Contact Closure Radio, Event Processor and any additional wiring and hardware associated with these items.

Provide the DMS controller with resident software stored in non-volatile memory. The Control Software, controller and communications must comply with the NTCIP standards identified in these

project special provisions: Provide sufficient non-volatile memory to allow storage of at least 500 multi-page messages and a test pattern program.

Furnish the controller cabinet with, but not limited to, the following:

- Loadcenter with main and branch circuit breakers
- Power line filtering hybrid surge protectors
- Radio Interference Suppressor
- Communications surge protection devices
- Industrial-Grade UPS system and local disconnect
- Microprocessor-based controller
- Industrial-grade dial-up modem and interface cable
- Industrial-grade telephone line surge and lightning protector
- Serial interface port for local laptop computer
- Local control panel with Remote / Local control switch
- Interior lighting and duplex receptacle
- Adjustable shelves as required for components
- Temperature control system
- All interconnect harnesses, connectors, and terminal blocks
- All necessary installation and mounting hardware

Do not place a manufacturer name, logo, or other information on the faces of the controller cabinet visible to the motorist.

Provide cabinets capable of housing the components and sized to fit space restrictions. Design the cabinet layout for ease of maintenance and operation, with all components easily accessible. Submit a cabinet layout plan for approval by the Engineer.

Locate louvered vents with filters in the cabinet to direct airflow over the controller and auxiliary equipment, and in a manner that prevents rain from entering the cabinet. Fit the inside of the cabinet, directly behind the vents, with a replaceable, standard-size, commercially available air filter of sufficient size to cover the entire vented area.

Provide a torsionally rigid door with a continuous stainless steel hinge on the side that permits complete access to the cabinet interior. Provide a gasket as a permanent and weather resistant seal at the cabinet door and at the edges of the fan / exhaust openings. Use a non-absorbent gasket material that will maintain its resiliency after long-term exposure to the outdoor environment. Construct the doors so that they fit firmly and evenly against the gasket material when closed. Provide the cabinet door with louvered vents near the bottom, and with air filters as described in the paragraph above.

Provide a Plexiglas rack of appropriate size at a convenient location on the inside of the door to store the cabinet wiring diagrams and other related cabinet drawings. Provide a Corbin #2 main door lock made of non-ferrous or stainless steel material. Key all locks on the project alike, and provide 10 keys to the Engineer. In addition, design the handle to permit padlocking.

Provide the interior of the cabinet with ample space for housing the controller and all associated equipment and wiring; use no more than 75% of the useable space in the cabinet. Provide ample space in the bottom of the cabinet for the entrance and exit of all power, communications, and grounding conductors and conduit.

Arrange the equipment so as to permit easy installation of the cabling through the conduit so that they will not interfere with the operation, inspection, or maintenance of the unit. Provide adjustable metal shelves, brackets, or other support for the controller unit and auxiliary equipment. Leave a 3-inch minimum clearance from the bottom of the cabinet to all equipment, terminals, and bus bars.

Provide power supply monitoring circuitry to detect power failure and to automatically report the occurrence to the Control Software.

Install two 15-watt fluorescent light strips with shields, one in the top of the cabinet and the other under the bottom shelf. Design both lights to automatically turn on when the cabinet door is opened and turn off when the door closes.

Mount and wire a 120V ($\pm 10\%$) GFCI duplex receptacle of the 3-wire grounding type in the cabinet in a location that presents no electrical hazard when used by service personnel for the operation of power tools and work lights.

No cabinet resident equipment shall utilize the GFCI receptacle. There shall be one spare non-GFCI receptacle for future addition of equipment.

Mount a bug-proof and weatherproof thermostatically controlled fan and safety shield in the top of the cabinet. Size the fan to provide at least for two air exchanges per minute. Fuse the fan at 125% of the capacity of the motor. The magnetic field of the fan motor must not affect the performance of the control equipment. Use a fan thermostat that is manually adjustable to turn on between 80°F and 160°F with a differential of not more than 10°F between automatic turn-on and turn-off. Mount it in an easily accessible location, but not within 6 inches of the fan.

Install additional fans and/or heaters as needed to maintain the temperature inside the cabinet within the operating temperature range of the equipment within the cabinet as recommended by equipment manufacturer(s).

1. Wiring

The requirements stated herein shall apply wherever electrical wiring is needed for any DMS system assemblies and subassemblies such as controller cabinet, DMS enclosure, electrical panel boards and etc.

Neatly arrange and secure the wiring inside the cabinet. Where cable wires are clamped to the walls of the control cabinet, provide clamps made of nylon, metal, plastic with rubber or neoprene protectors, or similar. Lace and jacket all harnesses, or tie them with nylon tie wraps spaced at 6 inches maximum to prevent separation of the individual conductors.

Ensure all conductors are individually and uniquely labeled and are clearly visible without moving the conductor. Ensure all terminal conductors connect to the terminal strip in right angles. Before termination of the conductor remove any excess. The conductor shall be molded in such a fashion as to retain its relative position to the terminal strip if removed from the strip. Ensure no conductor runs across a work surface with the exception of connecting to that work surface. No conductor bundles can be support by fasteners that support work surfaces. Ensure all connectors, devices and conductors are installed in accordance to the manufactures guidelines.

Ensure all wiring complies with the latest NEC guideline in effect during installation. No conductor or conductor bundle may hang loose or create a snag hazard. Ensure all conductors are protected from damage. Ensure all solder joints are made using industry accepted practices and shall not fail due to vibration or movement. All welds must be in a manner that will not fail due to vibration. Ensure that all lamps and control boards are protected from damage.

Insulate all conductors and live terminals so they are not hazardous to maintenance personnel.

Route and bundle all wiring containing line voltage AC and / or shield it from all low voltage control circuits. Install safety covers to prevent accidental contact with all live AC terminals located inside the cabinet.

Use industry standard, keyed-type connectors with a retaining feature for connections to the Controller.

Label all equipment and equipment controls clearly.

Supply each cabinet with one complete set of wiring diagrams that identify the color-coding or wire tagging used in all connections. Furnish a water-resistant packet adequate for storing wiring diagrams, operating instructions, and maintenance manuals with each cabinet.

2. Power Supply and Circuit Protection

Design the DMS and controller for use on a system with a line voltage of $120V \pm 10\%$ at a frequency of $60 \text{ Hz} \pm 3 \text{ Hz}$. Under normal operation, do not allow the voltage drop between no load and full load of the DMS and its controller to exceed 3% of the nominal voltage.

Blackout, brownout, hunting, line noise, chronic over-voltage, sag, spike, surge, and transient effects are considered typical AC voltage defects. Protect the DMS system equipment so that these defects do not damage the DMS equipment or interrupt their operation. Equip all cabinets with devices to protect the equipment in the cabinet from damage due to lightning and external circuit power and current surges.

3. Circuit Breakers

Protect the DMS controller, accessories, and cabinet utilities with thermal magnetic circuit breakers. Provide the controller cabinet with a main circuit breaker sized according to the NEC. Use appropriately sized branch circuit breakers to protect the controller and accessories and for servicing DMS equipment and cabinet utilities.

4. Surge Suppressor

Install and clearly label filtering hybrid power line surge protectors on the load side of the branch circuit breakers in a manner that permits easy servicing. Ground and electrically bond the surge protector to the cabinet within 2 inches.

Provide power line surge protector that meets the following requirements:

Peak surge current occurrences	20 minimum
Peak surge current for an 8 x 20 microsecond wave shape	20,000 amperes
Clamp voltage	280 volts @ 20KA

Response time	Voltage never exceeds 250 volts during surge
Maximum current for filtered output	20 amperes for 120VAC*
Temperature range	-10°F to +150°F

* Capable of handling the continuous current to the equipment

5. Radio Interference Suppressor

Provide each controller cabinet with sufficient electrical and electronic noise suppression to enable all equipment in it to function properly. Provide one or more radio interference suppressors (RIS) connected between the stages of the power line surge suppressor that minimize interference generated in the cabinet in both the broadcast and the aircraft frequencies. Each RIS must provide a minimum attenuation of 50 decibels over a frequency range of 200 KHz to 75 MHz. Clearly label the suppressor(s) and size them at least at the rated current of the main circuit breaker but not less than 50 amperes.

Provide RIS that are hermetically sealed in a substantial metal case which is filled with a suitable insulating compound and have nickel-plated 10/24 brass stud terminals of sufficient external length to provide space to connect #8 AWG wires. Mount them so that the studs cannot be turned in the case. Properly insulate ungrounded terminals from each other, and maintain a surface linkage distance of not less than ¼" between any exposed current conductor and any other metallic parts. The terminals must have an insulation factor of 100-200 MΩ, dependent on external circuit conditions. Use RIS designed for 120 VAC ± 10%, 60Hz, and which meet the standards of UL and the Radio Manufacturers Association.

6. Communications Surge Protector

Equip the cabinet with properly labeled hybrid data line surge protectors that meet the following general requirements:

Surge current occurrences at 2000 ampere, 8 x 20 microsecond waveform	> 80
Surge current occurrences at 400 ampere, 10x700 microsecond waveform	> 80
Peak surge current for 8 x 20 microsecond waveform	10,000 A (2500 A/line)
Peak surge current for 10x700 microsecond waveform	500 A/line
Response time	< 1 nanosecond
Series resistance	< 15 Ω
Average capacitance	1500 pF
Temperature range	-10°F to 150°F
Clamp Voltage	As required to match equipment in application

7. Lightning Arrester

Protect the system with an UL-approved lightning arrester installed at the main service disconnect. It shall meet the following requirements:

Type of design	Silicon Oxide Varistor
Voltage	120/240 Single phase, 3-wires
Maximum current	100,000 amps
Maximum energy	3000 joules per pole
Maximum number of surges	Unlimited
Response time one milliamp test	5 nanoseconds
Response time to clamp 10,000 amps	10 nanoseconds
Response time to clamp 50,000 amps	25 nanoseconds
Leak current at double the rated voltage	None
Ground Wire	Separate

Protective devices may share a common neutral bus line from their point of attachment to the back panel neutral bus.

8. Uninterruptible Power Supply (UPS)

Provide the cabinet with an industrial grade UPS unit with AC line voltage conditioning capability, operating on a 120 volts AC, 60 Hz commercial line voltage. The unit must supply continuous power to operate the equipment connected to it if the primary power fails. The UPS must detect a power failure and provide backup power within 20 milliseconds. Transition to the UPS source from primary power must not cause loss of data or damage to the equipment being supplied with backup power. Provide an UPS with at least six (6) outlets for supplying conditioned AC voltage to the DMS controller, Event Processor, 900 MHz Serial Radio, 900 MHz Contact Closure Radio and the industrial-grade dial-up modems. Equipment connected to the UPS must operate without interruption during line voltage variations of 88 volts AC to 140 volts AC. Provide an UPS capable of operating within an ambient temperature range from -40° F to +185° F and at up to 95% humidity, non-condensing.

Provide a UPS unit capable of supplying 30 minutes of continuous backup power to the equipment connected to it when these equipment are operating at full load.

9. Controller Communications Interface

The controller will have the following interface ports:

- An EIA/TIA-232E port for remote communication using NTCIP
- An 10/100 Ethernet port for remote communication using NTCIP
- An EIA/TIA-232E port for onsite access using a laptop
- An EIA/TIA-232E auxiliary port for communication with a field device such as a UPS

- RS422/485 port to communicate with sign

Equip the controller cabinet with all modems and other equipment necessary to allow the controller to be addressed across a dial-up or cellular phone link. Provide communications data transmission at a user-selectable asynchronous rate between 1200 and 56 kbps.

10. Controller Local User Interface

Provide the controller with a Local User Interface (LUI) for at least the following functions:

- On / Off Switch: controls power to the controller.
- Control Mode Switch: for setting the controller operation mode to either remote or local mode.

LCD Display and Keypad: Allow user to navigate through the controller menu for configuration (display, communications parameter, etc) running diagnostics, viewing peripherals status, message creation, message preview, message activation, and etc. Furnish a LCD display with a minimum size of 240x64 dots with LED back light. Provide a 4X4 keypad.

11. Controller Address

Assign each DMS controller a unique address. The DMS controller compares its address with the address transmitted by control software; if the addresses match, then the controller processes the accompanying data.

12. Controller Functions

Design the DMS controller to continuously control and monitor the DMS independent of the Control Software.

Design the controller to display on the sign a message sent by the Control Software, a message stored in the sign controller memory, or a message created on-site by an operator using the controller keypad.

Provide the DMS controller with a watchdog timer to detect controller failures and to reset the microprocessor, and with a battery backed-up clock to maintain an accurate time and date reference. Set the clock through an external command from the Control Software or the Local User Interface.

13. DMS Controller Memory

Furnish each DMS controller with non-volatile memory. Use the non-volatile memory to store and reprogram at least one test pattern sequence and 500 messages containing a minimum of two pages of 45 characters per page. The Control Software can upload messages into and download messages from each controller's non-volatile memory remotely.

Messages uploaded and stored in the controller's non-volatile memory may be erased and edited using the Control Software and the controller. New messages may be uploaded to and stored in the controller's non-volatile memory using the Control Software and the controller.

14. Telephone Modem

Furnish an industrial grade modem with a data rate of 56 kbps. The modem must have a watchdog circuitry to continuously monitor the power supply, internal hardware, and operational

software. Ensure the modem will automatically reset itself in the event of a hardware or software problem.

15. Telephone Line Surge and Lightning Protector

Provide phone line surge and lightning protectors that are UL rated for industrial use and meet the following specifications:

Technology	Solid state with fast acting fuses and resistors
Usage	Telephone Line
Ports Protected	1 (2 lines per port)
Connectors	RJ11/12
Surge Capacity	1.9 kA / line
Clamp & Rated Voltage	270 V and 200 V
Max Frequency	50 MHz
Operating Temperature	-40° F to 185 ° F
Max Inline Resistance	22 Ohms
Ratings	UL 497A, IEC801-5, CCITT (ITU-T) K17

F. Photo-Electric Sensors

Install three photoelectric sensors with ½-inch minimum diameter photosensitive lens inside the DMS enclosure. Use sensors that will operate normally despite continual exposure to direct sunlight. Place the sensors so they are accessible and field adjustable. Point one sensor north or bottom of the sign. Place the other two perpendicular to, and pointed away from, the front and rear of the DMS, respectively.

Provide controls so that the Engineer can field adjust the following:

- The light level emitted by the pixels elements in each Light Level Mode.
- The ambient light level, at which each Light Level Mode is activated.

G. Equipment List

Provide a general description of all equipment and all information necessary to describe the basic use or function of the major system components. Include a general "block diagram" presentation. Include tabular charts listing auxiliary equipment, if any is required. Include the nomenclature, physical and electrical characteristics, and functions of the auxiliary equipment unless such information is contained in an associated manual; in this case include a reference to the location of the information. Include an itemized list of equipment costs.

Include a table itemizing the estimated average and maximum power consumption for each major piece of equipment.

H. Character Set Submittal

Submit an engineering drawing of the DMS character set including 26 upper case letters, 10 numerals, an asterisk (*), a dash, a plus sign (+), a designated lane diamond, a slash, an ampersand, and arrows at 0, 45, 90, 135, 180, 225, 270, and 315 degrees.

I. Wiring Diagram

Provide a wiring diagram for each DMS and each controller cabinet, as well as interconnection wiring diagrams for the system as a whole.

Complete and detailed schematic diagrams to component level shall be provided for all DMS assemblies and subassemblies such as driver boards, control boards, DMS controller, power supplies, etc. Such schematics shall enable an electronics technician to successfully identify any component on a board or assembly and trace its incoming and outgoing signals.

J. Routine Operation

Describe the operational routine, from necessary preparations for placing the equipment into operation to securing the equipment after operation. Show appropriate illustrations with the sequence of operations presented in tabular form wherever applicable. Include in this section a total list of the test instruments, aids and tools required to perform necessary measurements and measurement techniques for each component, as well as set-up, test, and calibration procedures.

K. Maintenance Procedures

Specify the recommended preventative maintenance procedures and checks at pre-operation, monthly, quarterly, semi-annual, annual, and "as required" periods to assure equipment operates reliably. List specifications, including tolerances, for all electrical, mechanical, and other applicable measurements, and / or adjustments.

L. Repair Procedures

Include in this section all data and step-by-step procedures necessary to isolate and repair failures or malfunctions, assuming the maintenance technicians are capable of analytical reasoning using the information provided in the section titled "Wiring Diagrams and Theory of Operation".

Describe accuracy, limits, and tolerances for all electrical, physical, or other applicable measurements. Include instructions for disassembly, overhaul, and re-assembly, with shop specifications and performance requirements.

Give detailed instructions only where failure to follow special procedures would result in damage to equipment, improper operation, danger to operating or maintenance personnel, etc. Include such instructions and specifications only for maintenance that specialized technicians and engineers in a modern electromechanical shop would perform. Describe special test set-up, component fabrication, and the use of special tools, jigs, and test equipment.

M. Field Trial

At the request of the Engineer, supply a three character demonstration module with characters of the size and type specified for the project, an appropriate control device and power supply to allow character display within 30 working days of the request. Perform a field trial on this module at a time and location selected by the Engineer.

This trial will allow the Engineer or his selected representatives to test the readability of the DMS at the maximum distance required for specified character size. Test the module with the sun directly above the DMS, and near the horizon in front of and behind the DMS (washout and back-lit conditions).

8.4 CONSTRUCTION

A. Description

This article establishes practices, procedures, minimum standards, and requirements for the installation of Dynamic Message Sign systems, auxiliary equipment and the construction of related structures.

Provide electrical equipment described in this specification that conforms to the standards of NEMA, UL, or Electronic Industries Association (EIA), wherever applicable. Provide connections between controllers and electric utilities that conform to NEC standards. Express wire sizes according to the American Wire Gauge (AWG).

Provide stainless steel screws, nuts, and locking washers in all external locations. Do not use self-tapping screws unless specifically approved by the Engineer. Use parts made of corrosion-resistant materials, such as plastic, stainless steel, brass, or aluminum. Use construction materials that resist fungus growth and moisture deterioration. Separate dissimilar metals by an inert dielectric material.

B. Layout

The Engineer will establish the actual location of each Dynamic Message Sign assembly. The Contractor shall be responsible for the proper elevation, offset, level, and orientation of all DMS assemblies. The location of service poles and controller cabinets as well as conduit lengths as shown in the plans is approximate based on available project data. Make actual field measurements to place conduit and equipment at the required location. Mark the proposed location of circuits and all other components for the Engineer's approval prior to installation. Submit a drawing showing all underground conduits and cables dimensioned from fixed objects or station marks.

C. Construction Submittal

When the work is complete, submit "as built" plans, and inventory sheets, and any other data required by the Engineer to show the details of actual construction and installation and all changes made during installation.

The "as built" plans will show: the DMS, controller, and service pole locations; DMS enclosure and controller cabinet wiring layouts; and wire and conduit routing. Include detailed drawings that identify the routing of all conductors in the system by cable type, color code, and function. Clearly label all equipment in the DMS system, controller cabinet, and DMS enclosure.

D. Conduit

Install the conduit system in accordance with Section 1715 of Standard Specification and NEC requirements for an approved watertight raceway.

Make bends in the conduit so as not to damage it or change its internal diameter. Install watertight and continuous conduit with as few couplings as standard lengths permit.

Clean conduit before, during, and after installation. Install conduit in such a manner that temperature changes will not cause elongation or contraction that might damage the system.

Attach the conduit system to and install along the structural components of the DMS structure assembly with beam clamps or stainless steel strapping. Install strapping according to the strapping manufacturer's recommendations. Do not use welding or drilling to fasten conduit to structural components. Space the fasteners at no more than 4 feet for conduit 1.5 inches and larger or 6 feet for

conduit 1.25 inches and smaller. Place fasteners no more than 3 feet from the center of bends, fittings, boxes, switches, and devices.

Locate underground conduit as shown in the Plans in a manner consistent with these Project Special Provisions.

Do not exceed the appropriate fill ratio on all cable installed in conduit as specified in the NEC.

E. Wiring Methods

Do not pull permanent wire through a conduit system until the system is complete and has been cleaned.

Color-code all conductors per the NEC (grounded neutral-WHITE, grounding-BARE or GREEN, and phase conductors RED and BLACK). Use approved marking tape, paint, sleeves or continuous colored conductors for No.8 AWG and larger. Do not mark a white conductor in a cable assembly any other color. You may strip a white, red, or black conductor at all accessible points and use it as a bare equipment-grounding conductor.

Bury underground circuits at the depth shown in the plans and surround with at least 3 inches of sand or earth back-fill free of rocks and debris. Compact backfill in 6-inch layers. Do not splice underground circuits unless specifically noted in the plans.

F. Equipment and Cabinet Mounting

Mount equipment securely at the locations shown in the plans, in conformance with the dimensions shown, and plumb and level. Install fasteners as recommended by the manufacturer and space them evenly.

Provide one key-operated, pin tumbler, dead bolt padlock, with brass or bronze shackle and case, conforming to Military Specification MIL-P-17802E (Grade I, Class 2, Size 2, Style A) for each electrical panel and switch on the project. Key all padlocks alike, and provide 10 keys to the Engineer.

Provide cabinets with all necessary mounting hardware in accordance with the Signal Specifications and the project plans.

Seal all unused conduit installed in cabinets at both ends to prevent water and dirt from entering the conduit and cabinet with approved sealing material.

Install a ground bushing attached inside the cabinet on all metal conduits entering the cabinet. Connect these ground bushings to the cabinet ground bus.

G. Cabinet and System Grounding

Ground the controller cabinet, DMS enclosure, DMS structure, and service entrance equipment per Sections 1098 and 1700 of the Standard Specifications, applicable addenda, typical drawings, Plans and these Project Special Provisions. Provide grounding circuits that are permanent and electrically continuous with a current carrying capacity high enough and an impedance low enough to limit the potential above ground to a safe level.

Run the power company neutral, conduit grounds, and all equipment grounds directly and independently of the ground bus. Use ground clamps, grounding and bonding bushings, lock nuts, and grounding electrodes that comply with UL Standard Electric Grounding and Bonding

Equipment. Use ground rods of 5/8-inch minimum diameter, 10 feet long, and made of copper-clad steel.

Make connections between ground electrodes and the ground wire using an exothermic welding process, cad weld or equivalent.

Ensure completed cabinet grounds have a resistance to ground of not more than 20 Ohms.

8.5 MEASUREMENT AND PAYMENT

The DMS will be measured and paid as the actual number of DMS systems furnished, installed, integrated, and accepted. No measurement will be made for traffic control, strapping hardware, structure mounting assembly, mounting hardware, controller, UPS, cabinet, conduit and conduit bodies, risers, wire, interface cables, connectors, circuit protection equipment, photo-electric sensors, tools, materials, all related testing, cost of labor, cost of transportation, incidentals, and all other equipment necessary to furnish and install a DMS system detailed in these project special provisions.

Payment will be made under:

Pay Item	Pay Unit
DMS.....	Each

9. NTCIP REQUIREMENTS

9.1 REFERENCES

This specification references several standards through their NTCIP designated names. The following list provides the full reference to the current version of each of these standards. Implement the most recent version of the standards listed in the following table including any and all approved or recommended amendments for each NTCIP component covered by these project specifications.

Table 1: NTCIP Standards

Abbreviated Number	Title
NTCIP 1101	<i>Simple Transportation Management Framework</i>
NTCIP 1201	<i>Global Object Definitions</i>
NTCIP 1203	<i>Object Definitions for Dynamic Message Signs</i>
NTCIP 2001	<i>Class B Profile</i>
NTCIP 2101	<i>SP-PMPP/232 Subnet Profile for PMPP over RS-232</i>
NTCIP 2102	<i>SP-PMPP/FSK</i>

	<i>Subnet Profile for PMPP over FSK Modem</i>
NTCIP 2103	<i>SP-PPP/232</i> <i>Subnetwork Profile for PPP over RS232 (Dial Up)</i>
NTCIP 2104	<i>SP-Ethernet</i> <i>Subnet Profile for Ethernet</i>
NTCIP 2201	<i>TP-Null</i> <i>Transport Profile</i>
NTCIP 2202	<i>TP-Internet</i> <i>Internet Transport Profile (TCP/IP and UDP/IP)</i>
NTCIP 2301	AP-STMF AP for Simple Transportation Management Framework

A. General Requirements

1. Subnet Level

Ensure each serial port on each NTCIP component supports NTCIP 2103 over a dial-up connection with a Contractor provided modem with data rates of 28.8 kbps, 19.2 kbps, 14.4 kbps, 9600 bps, 4800 bps, 2400 bps, 1200 bps, 600 bps, and 300 bps. Enable the NTCIP component to make outgoing, receive incoming calls as necessary, and support the following modem command sets:

- Hayes AT - Command Set
- MNP5
- MNP10
- V.42bis

Ensure each serial port on each NTCIP component supports NTCIP 2103 over a null-modem connection with data rates of 19.2 kbps, 14.4 kbps, 9600 bps, 4800 bps, 2400 bps, 1200 bps, 600 bps, and 300 bps.

Ensure each serial port on each NTCIP component supports NTCIP 2101 with data rates of 9600 bps, 4800 bps, 2400 bps, 1200 bps, 600 bps, and 300 bps.

Additionally, NTCIP components shall support NTCIP 2102 and NTCIP 2104.

NTCIP components may support additional subnet profiles at the manufacturer's option. At any one time, only one subnet profile shall be active on a given serial port of the NTCIP component. Ensure the NTCIP component can be configured to allow the field technician to activate the desired subnet profile and provide a visual indication of the currently selected subnet profile.

2. Transport Level

Ensure each NTCIP component complies with NTCIP 2201 and 2202.

NTCIP components may support additional transport profiles at the manufacturer's option. Ensure response datagrams use the same transport profile used in the request. Ensure each NTCIP component supports the receipt of datagrams conforming to any of the identified transport profiles at any time.

3. Application Level

Ensure each NTCIP component complies with NTCIP 1101 and 2301 and meets the requirements for conformance level 1 (NOTE - See amendment to standard).

Ensure each NTCIP component supports SNMP traps. An NTCIP component may support additional application profiles at the manufacturer's option. Ensure responses use the same application profile used by the request. Ensure each NTCIP component supports the receipt of application data packets at any time allowed by the subject standards.

4. Information Level

Each NTCIP component shall provide Full, Standardized Object Range Support of all objects required by these procurement specifications unless otherwise indicated below. The maximum response time for any object or group of objects shall be 200 milliseconds.

Design the DMS to support all mandatory objects of all mandatory conformance groups as defined in NTCIP 1201 and NTCIP 1203. Table 2 indicates the modified object requirements for these mandatory objects.

Table 2: Modified Object Ranges for Mandatory Objects

Object	Reference	Project Requirement
ModuleTableEntry	NTCIP 1201 Clause 2.2.3	Contains at least one row with moduleType equal to 3 (software). The module Make specifies the name of the manufacturer, the module Model specifies the manufacturer's name of the component and the model Version indicates the model version number of the component.
MaxGroupAddresses	NTCIP 1201 Clause 2.7.1	At least 1
CommunityNamesMax	NTCIP 1201 Clause 2.8.2	At least 3
DmsNumPermanentMsg	NTCIP 1203 Clause 2.6.1.1.1.1	At least 1*
DmsMaxChangeableMsg	NTCIP 1203 Clause 2.6.1.1.1.3	At least 21
DmsFreeChangeableMemory	NTCIP 1203 Clause	At least 20 when no messages

	2.6.1.1.1.4	are stored.
DmsMessageMultiString	NTCIP 1203 Clause 2.6.1.1.1.8.3	The DMS supports any valid MULTI string containing any subset of those MULTI tags listed in Table 4
DmsControlMode	NTCIP 1203 Clause 2.7.1.1.1.1	Support at least the following modes: Local External central CentralOverride

* Ensure the permanent messages display the content shown in Table 3.

Ensure the sign blanks if a command to display a message contains an invalid Message CRC value for the desired message.

Table 3: Content of Permanent Messages

Perm. Msg. Num.	Description
1	Permanent Message #1 blanks the display (i.e., consist of and empty MULTI string). It has a run-time priority of one (1).

Table 4: Required MULTI Tags

Code	Feature
f1	field 1 - time (12hr)
f2	field 2 - time (24hr)
f8	field 8 - day of month
f9	field 9 - month
f10	field 10 - 2 digit year
f11	field 11 - 4 digit year
fl (and /fl)	flashing text on a line by line basis with flash rates controllable in 0.5 second increments.
fo	Font
jl2	Justification - line - left
jl3	Justification - line - center

jl4	Justification – line – right
jl5	Justification – line – full
jp2	Justification – page – top
jp3	Justification – page – middle
jp4	Justification – page – bottom
Mv	moving text
NI	new line
Np	new page, up to 2 instances in a message (i.e., up to 3 pages/frames in a message counting first page)
Pt	page times controllable in 0.5 second increments.

The NTCIP component implements all mandatory and optional objects of the following optional conformance groups with FSORS.

5. Test Heading

a. Time Management

As defined in NTCIP 1201

b. Timebase Event Schedule

As defined in NTCIP 1201. The following list indicates the modified object requirements for this conformance group.

Table 5: Modified Object Ranges for the Timebase Event Schedule Conformance Group

Object	Reference	Project Requirement
MaxTimeBaseScheduleEntries	NTCIP 1201 Clause 2.4.3.1	At least 28
maxDayPlans	NTCIP 1201 Clause 2.4.4.1	At least 14
maxDayPlanEvents	NTCIP 1201 Clause 2.4.4.2	At least 10

c. Report

As defined in NTCIP 1201. The following list indicates the modified object requirements for this conformance group.

Table 6: Modified Object Ranges for the Report Conformance Group

Object	Reference	Project Requirement
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maxEventLogConfigs	NTCIP 1201 Clause 2.5.1	At least 50
eventConfigurationMode	NTCIP 1201 Clause 2.4.3.1	The NTCIP Component supports the following Event Configuration Modes: onChange greaterThanValue smallerThanValue
MaxEventLogSize	NTCIP 1201 Clause 2.5.3	At least 200
MaxEventClasses	NTCIP 1201 Clause 2.5.5	At least 16

d. PMPP

e. Font Configuration

As defined in NTCIP 1203. The following list indicates the modified object requirements for this conformance group.

Table 7: Modified Object Ranges for the Font Configuration Conformance Group

Object	Reference	Project Requirement
NumFonts	NTCIP 1203 Clause 2.4.1.1.1.1	At least 4*
MaxFontCharacters	NTCIP 1203 Clause 2.4.1.1.1.3	At least 127**

*Upon delivery, the first font is a standard 18" font. The second font is a double-stroke 18" font. The third font is a 28" font. The fourth font is empty.

**Upon delivery, the first three font sets are configured in accordance with the ASCII character set for the following characters:

- "A" thru "Z"- All upper case letters.
- "0" thru "9"- All decimal digits.
- Space (i.e., ASCII code 0x20).
- Punctuation marks shown in brackets [, ! ? - ' " " / ()]
- Special characters shown in brackets [# & * + < >]

f. DMS Configuration

As defined in NTCIP 1203.

g. MULTI Configuration

As defined in NTCIP 1203. The following list indicates the modified object requirements for this conformance group.

Table 8: Modified Object Ranges for the MULTI Configuration Conformance Group

Object	Reference	Project Requirement
DefaultBackgroundColor	NTCIP 1203 Clause 2.5.1.1.1.1	The DMS supports the following background colors: black
DefaultForegroundColor	NTCIP 1203 Clause 2.5.1.1.1.2	The DMS supports the following foreground colors: amber
DefaultJustificationLine	NTCIP 1203 Clause 2.5.1.1.1.6	The DMS supports the following forms of line justification: left center right full
defaultJustificationPage	NTCIP 1203 Clause 2.5.1.1.1.7	The DMS supports the following forms of page justification: top middle bottom
defaultPageOnTime	NTCIP 1203 Clause 2.5.1.1.1.8	The DMS supports the full range of these objects with step sizes no larger than 0.5 seconds
defaultPageOffTime	NTCIP 1203 Clause 2.5.1.1.1.9	The DMS supports the full range of these objects with step sizes no larger than 0.5 seconds
defaultCharacterSet	NTCIP 1203 Clause 2.5.1.1.1.10	The DMS supports the following character sets: eightBit

- h. **Default Message Control** as defined in NTCIP 1203
- i. **Pixel Service Control** as defined in NTCIP 1203
- j. **MULTI Error Control** as defined in NTCIP 1203
- k. **Illumination/Brightness Control**

As defined in NTCIP 1203. The following list indicates the modified object requirements for this conformance group.

Table 9: Modified Object Ranges for the Illumination/Brightness Control Conformance Group

Object	Reference	Project Requirement
dmsIllumControl	NTCIP 1203 Clause 2.8.1.1.1.1	The DMS supports the following illumination control modes: photocell timer manual
dmsIllumNumBrightLevels	NTCIP 1203 Clause 2.8.1.1.1.4	At least 16

l. Auxiliary I/O

m. Scheduling

As defined in NTCIP 1203. The following list indicates the modified object requirements for this conformance group.

Table 10: Modified Object Ranges for the Scheduling Conformance Group

Object	Reference	Project Requirement
NumActionTableEntries	NTCIP 1203 Clause 2.9.1.1.1.1	At least 21

n. Sign Status as defined in NTCIP 1203

o. Status Error as defined in NTCIP 1203

p. Pixel Error Status as defined in NTCIP 1203

q. Fan Error Status as defined in NTCIP 1203

r. Power Status as defined in NTCIP 1203

s. Temperature Status as defined in NTCIP 1203

Install necessary hardware for the support of items q, r, and s above.

Table 11: Some Optional Object Requirements

Object	Reference	Project Requirement
DefaultFlashOn	NTCIP 1203 Clause 2.5.1.1.1.3	The DMS supports the full range of these objects with step sizes no larger than

		0.5 seconds
DefaultFlashOff	NTCIP 1203 Clause 2.5.1.1.1.4	The DMS supports the full range of these objects with step sizes no larger than 0.5 seconds
DmsMultiOtherErrorDescription	NTCIP 1203 Clause 2.7.1.1.1.20	If the vendor implements any vendor-specific MULTI tags, the DMS shall provide meaningful error messages within this object whenever one of these tags generates an error.

6. Documentation

Supply software with full documentation, including a CD-ROM containing ASCII versions of the following Management Information Base (MIB) files in Abstract Syntax Notation 1 (ASN.1) format:

- The relevant version of each official standard MIB Module referenced by the device functionality.
- If the device does not support the full range of any given object within a Standard MIB Module, a manufacturer specific version of the official Standard MIB Module with the supported range indicated in ASN.1 format in the SYNTAX and/or DESCRIPTION fields of the associated OBJECT TYPE macro. Name this file identical to the standard MIB Module, except that it will have the extension ".man".
- A MIB Module in ASN.1 format containing all manufacturer-specific objects supported by the device with accurate and meaningful DESCRIPTION fields and supported ranges indicated in the SYNTAX field of the OBJECT-TYPE macros.
- A MIB containing any other objects supported by the device.

Allow the use of all of this documentation by any party authorized by the NCDOT for systems integration purposes at any time initially or in the future, regardless of what parties are involved in the systems integration effort.

B. NTCIP Acceptance Testing

Test the NTCIP requirements outlined above by a third party testing firm. Submit to the Engineer for approval a portfolio of the selected firm. Include the name, address, and a history of the selected firm in performing NTCIP testing along with references. Also, provide a contact person's name and phone number. Submit detailed NTCIP testing plans and procedures including a list of hardware and software to the Engineer for review and approval 10 days in advance of a scheduled testing date.

Develop test documents based on the NTCIP requirements of these project special provisions. The acceptance test will use the NTCIP Exerciser, and/or other authorized testing tools and will follow the guidelines established in the ENTERPRISE Test Procedures. Conduct the test in North Carolina on the installed system at the presence of the Engineer. Document and certify the results of the test by the firm conducting the test and submit the Engineer for review and approval. In case of failures, remedy the problem and have the Firm retest in North Carolina. Continue process until all failures are resolved. The Department reserves the right to enhance these tests as deemed appropriate to ensure device compliance.

9.2 MEASUREMENT AND PAYMENT

There will be no direct payment for the work covered by this section.

Payment for this work will be covered in the applicable sections of these project special provisions at the contract unit price for "DMS" and will be full compensation for all work listed above.

10. DMS TESTING REQUIREMENTS

10.1 GENERAL TEST PROCEDURES

Test the DMS system in a series of design approval and functional tests. The results of each test must meet the specified requirements. These tests should not damage the equipment. The Engineer will reject equipment that fails to fulfill the requirements of any test. Resubmit rejected equipment after correcting non-conformities and re-testing. Document completely all diagnoses and corrective actions. Modify all equipment furnished under this contract, without additional cost to the North Carolina Department of Transportation, to incorporate all design changes necessary to pass the required tests.

Provide 4 copies of all test procedures and requirements to the Engineer for review and approval at least 30 days prior to the testing start date.

Only use approved procedures for the tests. Include the following in the test procedures:

6. A step-by-step outline of the test sequence, showing a test of every function of the equipment or system tested
7. A description of the expected nominal operation, output, and test results, and the pass / fail criteria
8. An estimate of the test duration and a proposed test schedule
9. A data form to record all data and quantitative results obtained during the test.
10. A description of any special equipment, setup, manpower, or conditions required by the test

Provide all necessary test equipment and technical support. Use test equipment calibrated to National Institute of Standards and Technology (NIST) standards. Provide calibration documentation upon request.

Conform to these testing requirements and the requirements of these specifications. The Engineer will reject all equipment not tested according to these requirements. It is the Contractor's responsibility to ensure the DMS system functions properly even after the Engineer accepts the DMS test results.

Provide 4 copies of the quantitative test results and data forms containing all data taken, highlighting any non-conforming results and remedies taken, to the Engineer for approval. An authorized representative of the manufacturer must sign the test results and data forms.

10.2 DESIGN APPROVAL TESTS

Perform the following Design Approval Tests at the manufacturer's facility on the DMS modules, controller, controller cabinet, communications, and all other associated equipment before beginning full production on the units supplied for this Contract.

PROTOTYPE – Manufacture a prototype Dynamic Message Sign and controller of the type and size described in the project special provisions. Test the prototype according to the Design Approval and Operational Tests. When all corrections and changes (if any) have been made, the Department may accept the prototype DMS and controller as the physical and functional standard for the system furnished under this contract. You may use the prototype units on this project if, after inspection and rework (if necessary), they meet all physical and functional specifications. In the case of standard product line equipment, if the Contractor can provide test results certified by an independent testing facility as evidence of prior completion of successful design approval tests, then the Engineer may choose to waive these tests.

In each Design Approval Test designated below, successfully perform the tests described below under the conditions described. Apply the extreme conditions to all associated equipment unless stated otherwise in these Project Special Provisions (PSP).

- Start-up and operate the DMS locally using the Control Software.
- Use automatic (photoelectric sensor controlled), remote control using Control Software, and local control using Control Software to switch between "dim", "normal", and "bright" light levels.
- Operate the DMS with all display elements flashing continuously for 15 minutes at the maximum flash rate.
- Exercise the DMS by displaying static messages, flashing messages, and alternating static and flashing message sequences.
- Automatically poll the DMS using Control Software at various intervals and verify data received by the Control Software from the DMS.
- Download and edit messages.
- Execute status request on the DMS controller.
- Normal operations during uploading and downloading.
- Display a two-phase flashing message sequence of 45 characters.
- Select messages from the sign controller's local user interface.
- Activate the test sequence at chosen intervals.
- Display and verify several stored messages.
- Display a 2 page diagonal test pattern with half the pixel on and half off, alternating pixels on each page. Display this pattern for 1 hour.

The Design Approval Tests consists of all tests described in Section 2.2 "DMS Equipment Tests" of NEMA TS 4-2005 (Hardware Standards for Dynamic Message Signs with NTCIP Requirements). Perform all tests and submit certified results for review and approval.

10.3 OPERATIONAL FIELD TEST (ON-SITE COMMISSIONING)

Conduct an Operational Field Test of the DMS system installed on the project to exercise the normal operational functions of the equipment. The Operational Field Test will consist of the following tests as a minimum:

A. Physical Examination

Examine each piece of equipment to verify that the materials, design, construction, markings, and workmanship comply with the mechanical, dimensional, and assembly requirements of these Project Special Provisions.

Perform the following tests as a minimum:

- Verify that all surfaces are free of dents, scratches, weld burns, or abrasions. Round sharp edges and corners.
- Verify bend radius of cables is not excessive or could potentially cause damage.
- Verify all modules, lamps, and components are properly secured.
- Verify that there are no exposed live terminals.

B. Continuity Tests

Check the wiring to assure it conforms to the requirements of the appropriate paragraphs of this Specification.

C. Functional Tests

Perform the following functional tests:

- NTCIP exerciser/other testing on the assembled DMS system.
- Start-up and operation of the DMS locally using a laptop computer.
- Use automatic (photo-electric sensor controlled) DMS Control Software to switch between "dim", "normal", and "bright" light levels.
- Operation of the DMS with all display elements flashing continuously for 10 minutes at the maximum flash rate.
- Exercise the DMS by displaying static messages, flashing messages, and alternating static and flashing message sequences.
- Automatic polling of the DMS by the Control Software at various intervals and verification of data received by Control Software from DMS.
- Downloading and editing messages using Control Software.

- Execute status request on the DMS controller.
- Normal operations during uploading and downloading.
- Selection of messages from the sign controller's local user interface.
- Test sequence activation at chosen intervals.
- Display and verification of all stored messages.
- Resumption of standard operation upon interruption of electrical power.
- Demonstration of the Failure Detection and Response functions.
- Demonstrate proper operation of the Failure Log.
- Set controller clock using the Control Software.
- Execute system shutdown using first the Control Software and local user interface.
- Detection of power failure in the DMS enclosure and reporting of such failure to the Control Software.

Approval of Operational Field Test results does not relieve the Contractor to conform to the specifications in these Project Special Provisions. If the DMS system does not pass these tests, document a correction or substitute a new unit as approved by the Engineer. Re-test the system until it passes all requirements.

10.4 MEASUREMENT AND PAYMENT

There will be no direct payment for the work covered by this section.

Payment for this work will be covered in the applicable sections of these Project Special Provisions at the contract unit price for "DMS" and will be full compensation for all work listed above.

11. DMS STRUCTURE

11.1 DESCRIPTION

This section describes design, fabrication, furnishing, and erection of the Dynamic Message Sign (DMS) support structure and attachment of the DMS enclosure to the structure in accordance with the requirements of the Plans and the Project Special Provisions. Ensure the additional weight and loading characteristics associated with mounting the MVD units and antennas on the structure are accounted for with the design of the structure. Fabricate the DMS supporting structure from tubular steel. The DMS structure shall be the type as shown on the Plans.

The pedestal structure shall provide a minimum of 20 feet clearance from the high point of the road to the bottom of the DMS enclosure.

Steel post structures shall provide a minimum of 10 feet clearance from the high point of the road to the bottom of the DMS.

Ensure the design of the structure includes methods to mount the MVD unit(s), antenna(s) and their associated conduit, raceways and fittings to the structure. Design the DMS structure and submit shop drawings for approval by the Engineer.

Where the Standard Specifications or Plans require the design of a DMS structure, submit design computations and shop drawings to the Engineer for acceptance. A Professional Engineer that is registered in the state of North Carolina will prepare such computations and drawings. These must bear his signature, seal, and date of acceptance.

The provisions of Section 900 apply to all work covered by this section.

11.2 MATERIAL

Use materials that meet the following requirements of the NCDOT Standard Specifications:

Structural Steel	Section 1072
Overhead Structures	Section 1096
Signing Materials	Section 1092
Organic-Zinc Repair Paint	Article 1080-9
Reinforcing Steel	Sub-article 1070
Direct Tension Indicators	Sections 440 and 1072

11.3 CONSTRUCTION METHODS

A. General

Fabricate the DMS structure in accordance with the details shown in the approved contractor-supplied shop drawings and the requirements of these specifications.

No welding, cutting, or drilling in any manner will be permitted in the field, unless approved by the Engineer.

Drill bolt holes and slots to finished size. Holes may also be punched to finished size, provided the diameter of the punched holes is at least twice the thickness of the metal being punched. Flame cutting of bolt holes and slots will not be permitted.

Use two coats of a zinc-rich paint to touch up minor scars on all galvanized materials.

B. Shop Drawings

Submit to the Engineer for approval a complete design for the DMS structure including the mounting attachments for the MVD Units, DMS structure hardware, brackets for supporting the DMS. Base the design on the line drawings and wind speed of 130 miles per hour in accordance with the "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals".

The manufacturer of the DMS structure must ensure that design of the assembly is compatible with the DMS for mounting and attachment.

Submit six copies of completely detailed shop drawings and one copy of the design computations for the DMS assembly to the Engineer for approval prior to fabrication. Show in the shop drawings complete design and fabrication details including, provisions for attaching DMS to supporting structures, applicable material specifications, and any other information necessary for procuring and replacing any part of the completed DMS structure.

Allow a minimum of 40 working days for shop drawing approval after the Engineer receives them. If revised drawings are necessary, allow an additional 40 working days for review and approval of final shop drawings.

Approval of shop drawings by the Engineer will not relieve the Contractor of his responsibility for the correctness of drawings, or for the fit of all shop and field connections and anchors.

C. Design and Fabrication

1. Dynamic Message Sign Structure

Fabricate the DMS structure in accordance with the details shown in the approved shop drawings and with the requirements of these Project Special Provisions.

DMS structure dimensions shown in the Plans were estimated from available project data for bid purposes. Determine the actual dimensions from field measurements and approved DMS enclosure dimensions and furnish revised plans. Attach the DMS structure to the concrete foundation by the use of galvanized anchor bolts. Furnish anchor bolts with galvanized nuts, flat washers and lock washers. Provide anchor bolts that have an anchor plate with a nut at the end embed in concrete.

Fabricate the attachment assembly for mounting DMS in a manner that will ensure easy removal of the DMS.

2. Maintenance Walkway and Access Ladder for Pedestal Type Structure Only

NO MAINTENANCE WALKWAY OR ACCESS LADDER ARE REQUIRED FOR THE DMS ON THIS PROJECT.

3. Anchor Rod Nut Tightening Requirements for Metal Poles

a. Prior to installation

Protect the anchor rod threads from damage prior to installation and during installation.

Prior to installation of the rods in the foundation, turn nuts onto and off the rods, well past the elevation of the bottom of the leveling nuts. Turn by the effort of one worker using an ordinary wrench without a cheater bar. Report to the Engineer thread damage requiring unusually large effort.

b. During installation

1. Place leveling nuts (bottom nuts) on the anchor rods.

2. Place leveling nut washers on top of the anchor rod leveling nuts.

3. Place a rigid template on top of the leveling nuts to check the level of the nuts. Use beveled washers if the anchor nut and washer cannot be brought into firm contact with the template.

4. Verify that the distance between the bottom of the leveling nut and the top of the concrete foundation is no more than one anchor rod diameter. If an upright is required to be back-raked, then the distance between the bottom of the leveling nut and the top of the concrete foundation should be no more than one anchor rod diameter, averaged over the anchor rod group.

5. Place the base plate and structural element to which it is attached. However, do not attach to the upright element, during tightening of the anchor nuts, cantilever beams or arms with span in excess of 10 feet.

6. Place top nut washers.

7. Do not use lock washers.

8. Lubricate threads and bearing surfaces of top nuts with beeswax, stick paraffin, or other approved lubricant.

9. Place top nuts. Use beveled washers if the anchor nut and washer cannot be brought into firm contact with the base plate.

10. Tighten top nuts to snug tight. A snug-tight condition is defined as the washer and nut being in full contact with the base plate, and the application of the full effort of a workman with a 12-in wrench. Turn top nuts in increments following a star pattern (using at least two full tightening cycles).

11. To ensure proper pretensioning, after all top nuts have been brought to snug-tight condition, repeat the procedure on the leveling nuts. Turn leveling nuts in increments following a star pattern (using at least two full tightening cycles).

12. At this point, verify if beveled washers are required. Beveled washers are necessary under the leveling nut or top nut if any face of the base plate has a slope greater than 1:20 and/or any nut can not be brought into firm contact with the base plate.

13. Before further nut turning, make the reference position of the nut in the snug-tight condition with a suitable marking (ink or paint that is not water-soluble). Mark on the corner at the intersection of two flats with a corresponding reference mark on the plate at each nut. After tightening, verify the nut rotation.

14. Achieve pretensioning by turn-of-nut method. Turn the top nuts to 1/6 of a turn. Do so in a star pattern using at least two full-tightening cycles.

15. After installation, ensure that firm contact exists between the anchor rod nuts, washers, and base plate on any anchor rod installed.

16. For overhead DMS assemblies: The span type truss or the cantilever truss may be placed on the uprights or attached to the upright at this time.

17. After a period of no less than 4 days, and no more than 2 weeks, and in the presence of the Engineer, use a torque wrench to verify that a torque at least equal to 600 foot-pounds is provided on each top nut. For DMS cantilever or pedestal structures, verify the torque after erection of the remainder of the structure and attaching the DMS to the structure.

18. If any top nut torque reveals less than 600 foot-pounds of effort is required to move the nut, then tighten the nut to no less than 600 foot-pounds.

19. Calibrate the torque indicator on the wrench used for tightening the nuts annually if the project construction extends over a 12 month period. Provide the Engineer with certification of the calibration.

20. Do not place grout under the base plate

11.4 MEASUREMENT AND PAYMENT

The *DMS-1 Structure (Steel Post)* includes design, fabrication, construction, transportation, and attachment of the complete dynamic message sign structure, hardware, preparing and furnishing shop drawings, additional documentation, incidentals, traffic control and all other equipment and features necessary to furnish the structure described above.

The *DMS-2 Structure (Pedestal)* includes design, fabrication, construction, transportation, and attachment of the complete dynamic message sign structure, hardware, preparing and furnishing shop drawings, additional documentation, incidentals, traffic control and all other equipment and features necessary to furnish the structure described above.

Payment will be made under:

DMS-1 Structure (Steel Post).....Lump Sum

DMS-2 Structure (Pedestal)..... Lump Sum

12. DMS FOUNDATION

12.1 DESCRIPTION

The work covered by this section consists of the design and construction of DMS foundations. Design and construct either spread footing type foundations and/or drilled pier type foundations for each DMS structure unless otherwise directed by the Engineer. Ensure the additional weight and loading characteristics associated with mounting the MVD units and antennas on the structure are accounted for with the design of the footing.

12.2 MATERIAL

Portland Cement Concrete Production and Delivery Section 1000
Reinforcing SteelSection 1070
Anchor BoltsArticle 1072-6
Structural Steel and Overhead Sign StructuresSection 1072 and 1096

12.3 CONSTRUCTION METHODS

A. General

A North Carolina Licensed Professional Engineer must seal all design calculations, drawings and recommendations. Design foundations for the effects of dead, wind and ice loads in accordance with the wind zone load shown on the plans and Section 3 of the AASHTO Standard Specifications for

Structural Supports for Highway Signs, Luminaries and Traffic Signals (including interims). Use either spread footing or drilled pier foundations. In some instances, conflicts with drainage structures may dictate a certain type of foundation. Spread footings or dual drilled pier foundations are required for full span overhead signs (no single drilled pier foundations). When designing dual drilled pier foundations, a rectangular grade beam with a moment of inertia approximately equal to either of the drilled piers is required to connect the pier tops.

Provide reinforced concrete design in accordance with either Section 13.7.2 or 13.6.2 (whichever is applicable), allowable stress design method, of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals (including interims).

Consider sloping ground in the design, if applicable. Do not exceed an allowable bearing pressure of 3 ksf for spread footings. For drilled pier foundations, do not exceed an allowable lateral soil pressure of 4 ksf for AASHTO Group II Loading. Use the following default soil parameters and groundwater elevation for foundation design in the absence of a site-specific subsurface investigation in accordance with this provision.

Total Unit Weight = 120 pcf

Friction Angle = 30 degrees

Cohesion = 0 psf

Assume the groundwater elevation is at a depth of 7 feet below the ground surface. If the groundwater is encountered at a depth shallower than 7 feet, the overhead sign foundation must be redesigned based upon the actual field conditions. The default soil parameters and allowable pressures do not apply to very soft or loose soil, muck (generally, SPT blow counts per foot less than 4), weathered rock or hard rock (generally, SPT refusal). If soft or loose soil, muck, weathered rock or hard rock conditions are present, a site-specific subsurface investigation and foundation design is required in accordance with this provision.

Design spread footings in accordance with Sections 4.4.1 through 4.4.10, allowable stress design method, of the AASHTO Standard Specifications for Highway Bridges (including interims). Restrict uplift due to the eccentricity of the loading to one corner of the footing and the tension area may not exceed 25% of the total bearing area of the spread footing.

Design drilled piers in accordance with Sections 4.6.1 through 4.6.5, allowable stress design method, of the AASHTO Standard Specifications for Highway Bridges (including interims). If drilled piers are designed for skin friction only, increase the required length of each drilled pier a minimum of 6 inches to allow for sediment. If drilled piers are designed for end bearing, no additional length is required; however, the drilled piers will be subject to the cleanliness requirements in Section B under "Drilled Pier Construction:" below. Clearly state on the plans whether end bearing was accounted for in the foundation design.

Calculate expected vertical, lateral and torsional movements for single drilled pier foundations. Provide drilled pier foundations that result in a horizontal lateral movement of less than 1 inch at the top of the pier and a horizontal rotational movement of less than 1 inch at the edge of the pier. Also, use a factor of safety of 2.0 for lateral and torsion failure. Preliminary design methods described in Section 13.6.1.1 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals (including interims) may be used to incorporate a factor of safety in foundation design for lateral failure. Wings are required to increase torsion resistance for cantilever signs supported by a single drilled pier.

If a site-specific subsurface investigation is performed, use only an NCDOT Highway Design Branch Pre-Qualified Geotechnical Engineering Firm to provide a site specific foundation design.

B. Subsurface Investigation

If the default soil parameters or allowable pressures referenced above are not applicable for a given overhead sign foundation site, the Engineer may require a site-specific subsurface investigation. If the Engineer requires a site-specific subsurface investigation, the Department will perform the borings and provide the data to the Contractor. The subsurface investigation will be provided within two weeks of being notified by the Contractor that the site is at rough grade and accessible to a drill rig.

The Contractor may elect to conduct a site specific subsurface investigation at each proposed overhead sign foundation location in accordance with the requirements listed below, in lieu of using the default soil parameters and allowable pressures referenced above. If the Contractor elects to conduct a site-specific subsurface investigation, the costs of the investigation will be considered incidental to the "Footings for DMS- Structure" pay item.

Perform a boring at each overhead sign foundation location and provide boring data on an NCDOT Standard Boring Log form. Download this form from the NCDOT site at <http://www.ncdot.org/doh/preconstruct/highway/geotech/contractserv/investigation/Documents/BoringLogs.zip>. A licensed geologist or a professional engineer registered in the State of North Carolina and employed by an NCDOT Highway Design Branch pre-qualified Geotechnical Engineering Firm must seal each boring log. Use only an NCDOT Highway Design Branch pre-qualified Geotechnical Engineering Firm to conduct the subsurface investigation. Perform the investigation only after rough grade (within 3 feet of final grade) is achieved. Locate each boring within 3 feet of the center of the overhead sign foundation. Drill the boring to a minimum depth of 10 feet below the required spread footing bearing or drilled pier tip elevation, whichever is deeper. Conduct Standard Penetrating Tests at 1 ft, 2.5 ft, 5 ft, 7.5 ft, 10 ft, and every 5-ft after 10 ft below the rough grade in accordance with ASTM D-1586. A boring may be terminated above the minimum depth required (10 ft below the foundation elevation) if one of the following conditions occur: (a) a total of 100 blows have been applied in any 2 consecutive 5-in.intervals; (b) a total of 50 blows have been applied with less than 3-in. penetration.

C. Foundation Construction

Excavate footings for overhead sign structures in accordance with the applicable provisions of Section 410 of the 2006 Standard Specifications. Construct footings for overhead sign structures in accordance with Section 825 of the 2006 Standard Specifications. Construct all footings with Class A concrete. Where rectangular forms are used, use forms that have a chamfer strip at all corners for at least that distance protruding above finished ground. Use chamfers, which measure 1 inch along the diagonal face.

Securely brace anchor bolts positioned in the form and hold in proper position and alignment. Provide a rubbed finish on concrete surfaces to be exposed above finished ground in accordance with Section 825-6 (D) of the 2006 Standard Specifications. Do not erect overhead sign structures on foundations until the concrete has reached a minimum compressive strength of 3000 psi. Determine concrete compressive strength by nondestructive test methods or compressive strength tests made in accordance with AASHTO T22 and T23. Furnish equipment used for nondestructive tests and obtain Engineer's approval before performing the tests.

D. Drill Pier Construction

1. Excavation

Perform excavations for drilled piers to the required dimensions and lengths including all miscellaneous grading and excavation necessary to install the drilled pier. Depending on the subsurface conditions encountered excavation in hard rock, weathered rock or removal of boulders and debris may be required.

Dispose of drilling spoils as directed by the Engineer and in accordance with Section 802 of the 2006 Standard Specifications. Drilling spoils consist of all material excavated including water or slurry removed from the excavation either by pumping or with augers.

Construct drilled piers within the tolerances specified herein. If tolerances are exceeded, provide additional construction as approved by the Engineer to bring the piers within the tolerances specified. Construct drilled piers such that the axis at the top of the piers is no more than 3 inches in any direction from the specified position. Build drilled piers within 1% of the plumb deviation for the total length of the piers. When a grade beam is not required at the top of a pier, locate the top of pier elevation between 18 inches above and 6 inches above the finished grade elevation. Form the top of the pier such that the concrete is smooth and level.

If unstable, caving or sloughing soils are anticipated or encountered, stabilize drilled pier excavations with steel casing and/or polymer slurry. Steel casing may be either the sectional type or one continuous corrugated or non-corrugated piece. All steel casings should consist of clean watertight steel of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth or backfill. Use steel casings with an outside diameter equal to the specified pier size and a minimum wall thickness of 1/4-inch. Extract all temporary casings during concrete placement in accordance with this provision unless the Contractor chooses to leave the casing in place in accordance with the requirements below.

Any steel casing left in place will be considered permanent casing. When installing permanent casing do not drill or excavate below the tip of the permanent casing at any time such that the permanent casing is against undisturbed soil. The Contractor may excavate a hole with a minimum diameter of 12 inches smaller than the specified size of the pier in order to facilitate permanent casing installation provided the sides of the excavation do not slough during drilling such that the hole diameter becomes larger than the inside diameter of the casing. Permanent steel casings are only allowed for full span overhead signs as approved by the Engineer and prohibited for cantilever overhead signs. No additional compensation will be paid for permanent casing. If the Contractor chooses to use permanent steel casing, include all casing costs in the "Overhead Footing" pay item.

If the Contractor elects to use polymer slurry to stabilize the excavation, use one of the polymers listed in the table below:

PRODUCT	MANUFACTURER
SlurryPro EXL	KB Technologies Ltd 3648 FM 1960 West Suite 107 Houston, TX 77068 (800) 525-5237
Super Mud	PDS Company 105 West Sharp Street El Dorado, AR 71730 (800) 243-7455
Shore Pac GCV	CETCO Drilling Products Group 1500 West Shure Drive Arlington Heights, IL 60004 (800) 527-9948

Use slurry in accordance with the manufacturer's guidelines and recommendations unless approved otherwise by the Engineer. The Contractor should be aware that polymer slurry might not be appropriate for a given site. Polymer slurry should not be used for excavations in very soft or loose soils. If the excavation can not be stabilized with polymer slurry, the Engineer may require a site-specific subsurface investigation (if not done during design) and the use of steel casing. No additional time or compensation will be provided if both steel casing and polymer slurry are required to stabilize the excavation.

Construct all drilled piers such that the piers are cast against undisturbed soil. If a larger casing and drilled pier are required as a result of unstable or caving material during drilling, backfill the excavation before removing the casing to be replaced. No additional time or compensation will be provided for substituting a larger diameter drilled pier in order to construct a drilled pier cast against undisturbed soil.

Any temporary steel casing that becomes bound or fouled during pier construction and cannot be practically removed may constitute a defect in the drilled pier. Improve such defective piers to the satisfaction of the Engineer by removing the concrete and enlarging the drilled pier, providing a replacement pier or other approved means. All corrective measures including redesign as a result of defective piers will not be cause for any claims or requests for additional time or compensation.

2. Bottom Cleanliness

After a drilled pier excavation is complete and immediately before concrete placement, demonstrate acceptable bottom cleanliness of the drilled pier excavation to the Engineer for

approval if the plans indicate end bearing was used in the design. Provide any equipment, personnel and assistance required for the Engineer to inspect the drilled pier excavation. The pier excavation bottom is considered clean if no portion of the bottom area has more than 3 inches of sediment as determined by the Engineer.

3. Reinforcing Steel:

Completely assemble a cage of reinforcing steel consisting of longitudinal and spiral bars and place cage in the drilled pier excavation as a unit immediately upon completion of drilling unless the excavation is entirely cased. If the drilled pier excavation is entirely cased down to the tip, immediate placement of the reinforcing steel and the concrete is not required.

Lift the cage so racking and cage distortion does not occur. Keep the cage plumb during concrete placement operations and casing extraction. Check the position of the cage before and after placing the concrete.

Securely cross-tie the vertical and spiral reinforcement at each intersection with double wire. Support or hold down the cage so that the vertical displacement during concrete placement and casing extraction does not exceed 2 inches.

Do not set the cage on the bottom of the drilled pier excavation. Place plastic bolsters under each vertical reinforcing bar that are tall enough to raise the rebar cage off the bottom of the drilled pier excavation a minimum of 3 inches.

In order to ensure a minimum of 3 inches of concrete cover and achieve concentric spacing of the cage within the pier, tie plastic spacer wheels at five points around the cage perimeter. Use spacer wheels that provide a minimum of 3 inches "blocking" from the outside face of the spiral bars to the outermost surface of the drilled pier. Tie spacer wheels that snap together with wire and allow them to rotate. Use spacer wheels that span at least two adjacent vertical bars. Start placing spacer wheels at the bottom of the cage and continue up along its length at maximum 10-foot intervals. Supply additional peripheral spacer wheels at closer intervals as necessary or as directed by the Engineer.

4. Concrete

Begin concrete placement immediately after inserting reinforcing steel into the drilled pier excavation.

a. Concrete Mix

Provide the mix design for drilled pier concrete for approval and, except as modified herein, meeting the requirements of Section 1000 of the 2006 Standard Specifications.

Designate the concrete as Drilled Pier Concrete with a minimum compressive strength of 4500 psi at 28 days. The Contractor may use a high early strength mix design as approved by the Engineer. Make certain the cementitious material content complies with one of the following options:

- Provide a minimum cement content of 640 lbs/yd³ and a maximum cement content of 800 lbs/yd³; however, if the alkali content of the cement exceeds 0.4%, reduce the cement content by 20% and replace it with fly ash at the rate of 1.2 LB of fly ash per LB of cement removed.

- If Type IP blended cement is used, use a minimum of 665 lbs/yd³ Type IP blended cement and a maximum of 833 lbs/yd³ Type IP blended cement in the mix.

Limit the water-cementitious material ratio to a maximum of 0.45. Do not air-entrain drilled pier concrete.

Produce a workable mix so that vibrating or prodding is not required to consolidate the concrete. When placing the concrete, make certain the slump is between 5 and 7 inches for dry placement of concrete or 7 and 9 inches for wet placement of concrete.

Use Type I or Type II cement or Type IP¹ blended cement and either No. 67 or No. 78M coarse aggregate in the mix. Use an approved water-reducer, water-reducing retarder, high-range water-reducer or high-range water-reducing retarder to facilitate placement of the concrete if necessary. Do not use a stabilizing admixture as a retarder in Drilled Pier Concrete without approval of the Engineer. Use admixtures that satisfy AASHTO M194 and add admixtures at the concrete plant when the mixing water is introduced into the concrete. Redosing of admixtures is not permitted.

Place the concrete within 2 hours after introducing the mixing water. Ensure that the concrete temperature at the time of placement is 90°F or less.

b. Concrete Placement

Place concrete such that the drilled pier is a monolithic structure. Temporary casing may be completely removed and concrete placement may be temporarily suspended when the concrete level is within 42 to 48 inches of the ground elevation to allow for placement of anchor bolts and construction of grade beam or wings. Do not pause concrete placement if unstable caving soils are present at the ground surface. Remove any water or slurry above the concrete and clean the concrete surface of all scum and sediment to expose clean, uncontaminated concrete before inserting the anchor bolts and conduit. Resume concrete pouring within 2 hours.

Do not dewater any drilled pier excavations unless the Engineer approves the dewatering and the excavation is entirely cased down to tip. Do not begin to remove the temporary casing until the level of concrete within the casing is in excess of 10 feet above the bottom of the casing being removed. Maintain the concrete level at least 10 feet above the bottom of casing throughout the entire casing extraction operation except when concrete is near the top of the drilled pier elevation. Maintain a sufficient head of concrete above the bottom of casing to overcome outside soil and water pressure. As the temporary casing is withdrawn, exercise care in maintaining an adequate level of concrete within the casing so that fluid trapped behind the casing is displaced upward and discharged at the ground surface without contaminating or displacing the drilled pier concrete. Exerting downward pressure, hammering or vibrating the temporary casing is permitted to facilitate extraction.

Keep a record of the volume of concrete placed in each drilled pier excavation and make it available to the Engineer.

After all the pumps have been removed from the excavation, the water inflow rate determines the concrete placement procedure. If the inflow rate is less than 6 inches per half-hour, the concrete placement is considered dry. If the water inflow rate is greater than 6 inches per half-hour, the concrete placement is considered wet.

- **Dry Placement:** Before placing concrete, make certain the drilled pier excavation is dry so the flow of concrete completely around the reinforcing steel can be certified by visual inspection. Place the concrete by free fall with a central drop method where the concrete is chuted directly down the center of the excavation.
- **Wet Placement:** Maintain a static water or slurry level in the excavation before placing concrete. Place concrete with a tremie or a pump in accordance with the applicable parts of Sections 420-4 and 420-5 of the 2006 Standard Specifications. Use a tremie tube or pump pipe made of steel with watertight joints. Passing concrete through a hopper at the tube end or through side openings as the tremie is retrieved during concrete placement is permitted. Use a discharge control to prevent concrete contamination when the tremie tube or pump pipe is initially placed in the excavation. Extend the tremie tube or pump pipe into the concrete a minimum of 5 feet at all times except when the concrete is initially introduced into the pier excavation. If the tremie tube or pump pipe pulls out of the concrete for any reason after the initial concrete is placed, restart concrete placement with a steel-capped tremie tube or pump pipe.

Once the concrete in the excavation reaches the same elevation as the static water level, placing concrete with the dry method is permitted. Before changing to the dry method of concrete placement, remove any water or slurry above the concrete and clean the concrete surface of all scum and sediment to expose clean, uncontaminated concrete.

Vibration is only permitted, if needed, in the top 10 feet of the drilled pier or as approved by the Engineer. Remove any contaminated concrete from the top of the drilled pier and wasted concrete from the area surrounding the drilled pier upon completion.

c. Concrete Placement Time:

Place concrete within the time frames specified in Table 1000-2 of the 2006 Standard Specifications for Class AA concrete except as noted herein. Do not place concrete so fast as to trap air, water, fluids, soil or any other deleterious materials in the vicinity of the reinforcing steel and the annular zone between the rebar cage and the excavation walls. Should a delay occur because of concrete delivery or other factors, reduce the placement rate to maintain some movement of the concrete. No more than 45 minutes is allowed between placements.

E. Scheduling and Restrictions

If caving or sloughing occurs, no additional compensation will be provided for additional concrete to fill the resulting voids.

During the first 16 hours after a drilled pier has achieved its initial concrete set as determined by the Engineer, do not drill adjacent piers, do not install adjacent piles and do not allow any heavy construction equipment loads or "excessive" vibrations to occur at any point within a 20 foot radius of the drilled pier.

In the event that the procedures described herein are performed unsatisfactorily, the Engineer reserves the right to shut down the construction operations or reject the drilled piers. If the integrity of a drilled pier is in question, use core drilling, sonic or other approved methods at no additional cost to the Department and under the direction of the Engineer. Dewater and backfill core drill holes with an approved high strength grout with a minimum compressive strength of 4500 psi. Propose

remedial measures for any defective drilled piers and obtain approval of all proposals from the Engineer before implementation. No additional time or compensation will be provided for losses or damage due to remedial work or any investigation of drilled piers found defective or not in accordance with this provision or the plans.

12.4 MEASUREMENT AND PAYMENT

The work covered by this section to be paid for will be the actual number of cubic yards of concrete, which has been incorporated into the completed and accepted footing. Computing the number of cubic yards of concrete will be done from the dimensions shown in the plans or from revised dimensions authorized by the Engineer, calculated to the nearest 0.01 of a cubic yard. This item also includes all costs associated with traffic control during the pouring of the concrete.

Payment will be made under:

Footings for DMS- _ Structure..... Cubic Yards

13. DMS DIRECT TENSION INDICATORS

13.1 GENERAL

Use direct tension indicators on all ASTM A325 high strength bolt connections in overhead and cantilever sign structures.

Provide direct tension indicators that conform to these Project Special Provisions, the requirements of ASTM F959 and the manufacturer's recommendations.

13.2 MATERIAL REQUIREMENTS

Use direct tension indicators whose material, manufacturing process, performance requirements, workmanship and certification requirements conform to the requirements of ASTM F959.

For Type 3 high strength bolts, use direct tension indicators mechanically galvanized to ASTM B695 Class 50, then with 1 mil of baked epoxy applied.

For plain Type 1 high-strength bolts, use direct tension indicators that are plain or mechanically galvanized to ASTM B695 Class 50.

For galvanized Type 1 high strength bolts, use direct tension indicators that are mechanically galvanized to ASTM B695 Class 50 only.

13.3 TEST DOCUMENTS

Furnish the Engineer with a copy of the manufacturer's test report for each lot of direct tension indicators used in the project. The manufacturer must perform these tests according to the requirements of ASTM F959. Include in each test report the lot number of the indicators, manufacturer's name, tension load when indicators were tested, gap clearance, nominal size, coating thickness, date tested, and name and location of the company that performed the tests.

Furnish the Engineer with a copy of the manufacturer's instructions for installing the direct tension indicators before installation begins along with at least 1 metal feeler gauge for each 50 direct tension indicators shipped.

Use only direct tension indicators whose container lot numbers match the lot numbers on the test documents.

13.4 REQUIRED TEST SAMPLES

Furnish the Engineer with three samples of load indicating washers from each lot number, size and type for departmental tests along with two of the metal feeler gages required for performing the tests.

13.5 CONSTRUCTION METHODS

A. Installation

Install the direct tension indicators in strict compliance with the manufacturer's written instructions.

Install the direct tension indicator under the bolt head normally. If it is necessary to install the direct tension indicator under the nut, or if the bolt head must be turned, install additional hardened washers in accordance with the manufacturer's instructions.

Have a tension-indicating device on the project for determining the tension imposed on a fastener when the protrusions on direct tension indicator have been properly compressed.

Test three samples from each lot of direct tension indicators in the presence of the Engineer. Achieve a minimum bolt tension 5 percent greater than that required by Table 440-1 in Article 440-10 of the Standard Specifications. Do not substitute direct tension indicators for the hardened steel washers required with short slotted or oversized holes, but you may use them in conjunction with them.

Initially install the direct tension indicators to a snug tight condition as specified in Section 440-10 Paragraph (C) (3) of the Standard Specifications. After the initial tightening, fully tighten the fasteners, as recommended by the manufacturer of the direct tension indicators, beginning at the most rigid part of the joint and continuing toward its free edges.

Use a wrench to tighten fasteners containing direct tension indicators of the type and capacity recommended by the manufacturer and which is clean and lubricated. Use an air supply and hoses that are in good condition and provide air pressure of at least 100 psi at the wrench.

Perform any heating of structural steel required for corrections in the vicinity of fasteners before direct tension indicators are installed.

B. Inspection

The Engineer will inspect for correct tightening of bolts by inserting a 0.005-inch thickness feeler gauge into the openings between adjacent flattened protrusions of the direct tension indicator. The tension is correct when the number of spaces the gage cannot enter is equal to or greater than the value shown in the table below.

<u>Number of Spaces in Washer</u>	<u>Number of Spaces Gage is Refused</u>
4	2
5	3
6	3
7	4

The gage must not be able to enter any spaces when the direct tension indicator is used under the turned element.

Do not tighten bolts to a no visible gap condition. Replace bolts that have a direct tension indicator with no visible gap and tighten the bolts with a direct tension indicator.

The Engineer will inspect at least 10 percent, but no less than 2, of the bolts in each connection, using the metal feeler gages provided by the Contractor.

Ensure that the part of the fastener being restrained from turning does not rotate during the tightening process, thereby abrading away a portion of the direct tension indicator protrusions.

Ensure that none of the direct tension indicator protrusions are accidentally partially flattened before installing in the structural steel joints.

Do not reuse direct tension indicators. If it becomes necessary to loosen a bolt previously tensioned, discard and replace the direct tension indicator.

13.6 MEASUREMENT AND PAYMENT

There will be no direct payment for the work covered by this section.

Payment for this work will be covered in the applicable sections of these Project Special Provisions at the contract unit price for "Footings for DMS- _ Structure " and will be full compensation for all work listed above.

14. CENTRAL SOFTWARE MODIFICATIONS

14.1 DESCRIPTION

There is an existing Dedicated Workstation Computer located at the Division 2 – Traffic Management Center with existing CCTV Camera Software (Protronix VideoPro video management system software), Closed Loop Signal System Software (Econolite Translink 32), Dynamic Message Sign Software (Daktronics Vanguard DMS control software) that operates with existing devices located within the Division's Boundaries. The Contractor is responsible for verifying and identifying the various software packages on the dedicated workstation computer. Ensure that the DMS software and MVD/Event Processor Software provided under this contract are supported by the existing computers software packages.

Ensure that the above reference software packages are not compromised while upgrading the dedicated workstation computer to integrate the new system software associated with this project.

Interface the above listed equipment with all necessary software and cabling required to provide a complete and fully operational system. Integrate the system such that each DMS and the Advance Queue Detection Warning Systems can be controlled, monitored and updated from the Traffic Management Center.

Work with the Division 2 – Division Traffic Engineer to make any hardware and software modifications (if any) to the existing Dedicated Workstation Computer.

14.2 CONSTRUCTION METHODS

A. General

Integrate the Advanced Queue Detection Warning System along with the new Dynamic Message Signs installed under this project onto the existing Dedicated Workstation Computer. Update software databases, link new the new devices with proper software drivers, system graphic displays, and align new devices with the appropriate logical and physical server ports.

Ensure the operator can select each DMS Controller by clicking on the icon on the Graphical User Interface (GUI) or drop down menu, which will launch the software to make the connection to the intended DMS or the Event Processor.

Ensure that communications with any existing field devices already programmed on the computer remains operational; this includes existing CCTV Cameras, Closed Loop Signal Systems, Dynamic Message Signs, etc.

Provide information and assistance to the Division 2 – Division Traffic Engineer or his designated liaison to aid in updating the system and making modifications as necessary.

14.3 MEASUREMENT AND PAYMENT

Payment will be made under *Central Software Modifications* and will include all work associated with integrating/adding the Advanced Queue Detection Warning System and DMS Software to the existing Dedicated Workstation Computer and its associated software. Payment will be "Lump Sum".

No payment will be made for any hardware or work associated with installing, connecting cables, electrical cables, surge protection devices, mounting hardware, nuts, bolts, brackets, and for integration of these devices to form a complete and fully operation system.

Pay Item	Pay Unit
Central Software Modifications.....	Lump Sum

15. DMS DOCUMENTS AND SUBMITTALS

15.1 GENERAL

The submittals listed below complement requirements stated throughout these project special provisions and do not replace them.

Provide all drawings on 22" x 34" sheet of paper unless approved by the Engineer otherwise. The drawing must fill the entire sheet of paper excluding a 2" border all around.

Supplement each drawing by catalog cut sheets and parts list. Provide parts list in the following format:

Part ID	Source	Part number	Alternate source	Alternate Part number	Description

15.2 DRAWINGS AND DOCUMENTS' CERTIFICATIONS

Provide the following drawings, documents, plans, and calculations approved by a Professional Engineer registered in the state of North Carolina that bears his/her signature, seal, and date of acceptance:

- Plans for the DMS enclosure.

- Electrical power distribution drawings and power consumption calculations.

15.3 MECHANICAL

This set of submittals includes, but is not limited to, material specifications, catalog cut sheets, parts list, and fabrication drawings for DMS controller cabinet(s), DMS enclosure, character assemblies, and etc. Engineering calculations must accompany drawings as needed and applicable.

15.4 ELECTRICAL

This set of submittals includes, but is not limited to, material specifications, catalog cut sheets, parts list, and wiring diagrams within the DMS controller cabinet, DMS enclosure, DMS controller cabinet/enclosure, service entrance cabinet/panels, and etc. This set of submittals also includes power consumption calculations, wire and conduit size calculations, voltage drop calculation, and etc. The DMS electrical system: wires, conduits, breakers, panel-boards, etc. must meet the latest edition of NEC requirements and must be sealed and signed by a Professional Engineer registered in the state of North Carolina.

15.5 ELECTRONICS

This set of submittals includes, but is not limited to, material specifications, catalog cut sheets, parts list, and schematic diagrams for all electronics assemblies and sub-assemblies used in the system.

15.6 BLOCK DIAGRAMS

A block diagram shall be provided for the following:

- DMS System
- DMS Controller Cabinet
- DMS Enclosure
- DMS Controller
- DMS Display Boards
- DMS Driver Board(s)
- DMS Lighting Control Board(s)
- Interface Board(s)
- And other system's boards/assemblies that help in understanding, troubleshooting, and repairing the system and/or system's components.

15.7 LED'S

This set of submittals includes LED data/specification sheets and the LED selection procedure as required by section 3.2.B.5.

15.8 BENCH REPAIR DOCUMENTATION

Provide all schematics drawings, board layout information, equipment manuals, software, and firmware required to perform bench repair to the component level and testing of electronic equipment and equipment circuit boards. Failure to supply the documentation required by this Section of the project special provisions shall be grounds for rejection of the submitted item due to incomplete information. Provide schematic drawings as well as the board layout drawings that identify all components in the equipment or circuit board including but not limited to all digital and analog integrated circuits devices (ICs), all discrete electronic components, transformers, relays, and other electronic devices and components used in the circuits. Provide schematic drawings that show pin to pin interconnection between components. Provide a complete parts list for each circuit board's components. Provide a copy of all software required to operate any equipment or circuit boards for the purposes of test or system software to test operation of equipment used as a system component.

15.9 PROPRIETARY PARTS

Provide a list of all proprietary electronic component parts along with a price at which the vendor shall supply non-warranty parts for a two-year period. Failure to supply this required proprietary part and price information may be grounds for rejection of the submitted item due to incomplete information. A part is considered a proprietary part if it is designed and manufactured exclusively for a specific application and is not commercially available for sale to the general public. In addition, any item that is sole source (e.g. available only from the vendor or from a single known manufacturer) is considered proprietary and should be identified along with the sole source. Identify and quote a price for parts that are no longer being manufactured and identify the item as one that is no longer manufactured.

15.10 LIMITS ON USE BY NCDOT AND PROTECTION OF MANUFACTURER'S INFORMATION

NCDOT technicians will use the above documentation (schematics, drawings, software, firmware, manuals, etc.) exclusively for the following purposes: diagnosing and performing repairs on malfunctioning equipment, equipment circuit boards, and malfunctioning systems; operational test of repaired equipment, circuit boards, systems; and performing authorized upgrades to equipment, circuit boards, and software supplied under this contract. NCDOT technicians will not use or copy devices or software for any purpose other than diagnosis, repair, and testing or to perform authorized firmware or software upgrades.

Upon notification by the manufacturer, the Department agrees not to divulge any proprietary or otherwise confidential information contained in the above required documentation. NCDOT agrees to protect and secure any proprietary documentation identified by the manufacturer as proprietary or confidential. Upon request by the manufacturer, agrees to sign a binding non-disclosure agreement with the manufacturer or other business that is providing documentation it considers proprietary or otherwise confidential.

15.11 MEASUREMENT AND PAYMENT

There will be no direct payment for the work covered by this section.

Payment for this work will be covered in the applicable sections of these project special provisions at the contract unit price for "DMS" and will be full compensation for all work listed above.

16. SYSTEM SUPPORT EQUIPMENT

16.1 DESCRIPTION

Furnish system support equipment with all necessary hardware in accordance with the plans and specifications to be used for emergency restoration of the system. Comply with the provisions of Section 1700 of the 2006 Standard Specifications.

Furnish equipment with test probes/leads, batteries (for battery operated units), and line cords (for AC operated units). Provide operating instructions and maintenance manuals with each item.

Prior to starting any system testing, furnish all system support equipment.

A. Microwave Vehicle Detection Unit

Furnish a Microwave Vehicle Detection Unit identical to the type installed in the field to be used for emergency restoration of the system.

B. Event Processor

Furnish an Event Processor identical to the type installed in the field to be used for emergency restoration of the system.

C. 900 MHz Contact Closure Radio

Furnish a 900 MHz Contact Closure Radio identical to the type installed in the field to be used for emergency restoration of the system.

D. DMS Controller

Furnish a DMS Controller identical to the type installed in the field to be used for emergency restoration of the system.

16.2 MEASUREMENT AND PAYMENT

Furnish Microwave Vehicle Detection Unit will be measured and paid as the actual number of microwave vehicle detection unit, furnished and accepted.

Furnish Event Processor(s) will be measured and paid as the actual number of Event Processor(s), furnished and accepted.

Furnish 900 MHz Contact Closure Radio will be measured and paid as the actual number of 900 MHz contact closure radio units, furnished and accepted.

Furnish DMS Controller will be measured and paid as the actual number of furnish DMS Controller units, furnished and accepted.

Payment for the above referenced items will include all shipping, handling, and storage fees.

Payment will be made under:

Pay Item	Pay Unit
Furnish Microwave Vehicle Detector Unit.....	Each
Furnish Event Processor.....	Each
Furnish 900 MHz Contact Closure Radio.....	Each
Furnish DMS Controller.....	Each

17. SYSTEMS OPERATIONAL TEST AND OBSERVATION PERIOD

17.1 DESCRIPTION

Once all hardware has been installed and the system integration is complete, perform a System Operational Test, which fully exercises all functions of the system including the MVD's, the Event Processor, the 900MHz Serial Radios and the 900MHz Contact Closure Radios, and the DMS signs. Submit for approval by the Engineer, 30 days prior to the date established for the Systems Test, a test plan that outlines the testing for each piece of equipment as well as an overall test procedure, which will be the Systems Test. The Engineer who, within fifteen (15) days of receipt, will either approve or indicate changes required for approval of the test plan.

Submit, as a minimum, the System Operational Test with all necessary documentation and tests to satisfy the following: MVD field testing, Event Processor field testing, 900 MHz Serial Radio and 900MHz Contact Closure Radio field testing and DMS field testing. Ensure that each individual component of the system is working prior to conducting the final System Operational Test, which will include interfacing the system with the DMS.

Conduct and demonstrate all DMS Sign Testing requirements as covered by the Section Titled "DMS Testing Requirements".

The Contractor shall supply a Laptop or PDA loaded with the appropriate MVD and Event Processor setup software and DMS Software for use during this test. The laptop or PDA is not an item to be provided to the Engineer. It is only to be supplied for testing.

Demonstrate that the Event Processor setup software has been set up successfully.

Perform individual diagnostic tests of the following items:

- Remote ability to change sign messages
- Remote ability to change the predefined event(s) in the Event Processor
- Remote ability to check Event Processor data
- Each MVD capability to detect both directions of travel and send data to Event Processor
- Power outage at Event Processor "normally closed" contact closure fail safe condition
- MVD detection capability
- Communication between MVD's and Event Processor
- Communications between the Event Processor and the DMS
- Successful dialup connections from Central to the Event Processor and DMS signs

In addition, the field tests will include inspection of all cabinets, electrical service, grounding system, wire & cabling, labeling, and all other components installed for the Advanced Queue Detection Warning System.

Demonstrate that all wireless equipment has been installed properly and operates as specified in these Project Special Provisions. Demonstrate that the communication and signal strength between the MVD and Event Processor and between the Event Processor Controller and the DMS sign are at 98% or better. The project will not be accepted until the final wireless tests described have been performed with acceptable results.

A. Halt of Systems Operational Test

In the event that any component of the system malfunctions or operates below the level specified the Systems Operational Test must be halted. The Contractor will determine and correct the problems, including repair or replacement of equipment, at no cost to the Department. Upon correction of the problems to the satisfaction of the Engineer, testing will resume.

B. 30-Day Observation Period

Upon completion of all project work, the successful completion of the System Operational Test and the correction of all known deficiencies, including minor installation items, a 30-day Observation Period will commence. This Observation Period will consist of a 30-day period of normal operation without any failures. The 30-day Observation Period will be warranted by the payment and performance bond. The purpose of this period is to ensure that all components of the system function in accordance with these Project Special Provisions over an extended length of time.

Respond to system or component failures (or reported failures) that occur during the 30-day Observation Period within 48 hours. Correct said failures within 72 hours. Failures that cannot be corrected within 72 hours will suspend the timing of the 30-day Observation Period beginning at the time when the failure occurred. After the cause of such failures has been corrected, timing of the 30-day Observation Period will resume. Failures that necessitate a redesign of any major component will terminate the Observation Period. Once the components have been redesigned or replaced, the 30-Day Observation Period will be restarted from zero. Failures in any of the components exceeding a total of three (3) occurrences will terminate the 30-day Observation Period. Once the failures have been corrected, the 30-day Observation Period will be restarted from zero.

All documentation must be completed prior to the end of the 30-day Observation Period. The 30-day Observation Period will be considered part of the contract time. Final acceptance will occur upon the successful completion of the 30-day Observation Period and after all documentation, requirements have been fully satisfied.

17.2 MEASUREMENT AND PAYMENT

No separate payments will be made for Systems Operational Tests or Observation Period as these will be considered incidental to work covered elsewhere.

18. TRAINING

18.1 DESCRIPTION

Provide training courses covering the operation and maintenance of the DMS Signs, MVD's and Event Processor System, and Wireless Communications Systems (Contact Closure and Serial) included under this project.

Provide department approved training courses covering the operation and maintenance of the equipment being supplied as part of the system. Training courses shall be required for both the control center elements and field elements of the system. Provide training material to present formal classroom as well as "hands-on" user training in the operation, maintenance, and troubleshooting of the equipment being supplied as part of the system. Each category shall consist of demonstration and hands-on activities. Particular attention shall be given to precautions that must be observed in operating the equipment.

Provide department approved qualified instructors or personnel approved by the Engineer to conduct the training courses. Training Department personnel must be able to properly operate, maintain, and troubleshoot each piece of equipment and software within the system.

All training courses shall be conducted at a Contractor provided location within the time mutually agreed upon by the Engineer and the Contractor. Provide training materials for up to 15 attendees. Training course shall not exceed 8 hours on any given day.

18.2 MATERIALS

A. General

Provide training to properly install, operate, maintain, diagnose and repair all equipment and software associated with this project. Thirty (30) days prior to commencement of the training course, submit detailed course curricula, draft manuals, and handouts, and resumes of the instructors for review and approval. The Engineer may request modification of the material and request courses desired by the Department.

For all training programs, a staff of engineers, technicians, and maintenance personnel familiar with the system will be the training participants.

For each session, provide training materials (manuals, notebooks, handouts, etc.) as specified in the Documentation Section of these Project Special Provisions.

Conduct all training courses at a location provided by the Contractor and approved by the Engineer. Training shall be conducted in the Division 2 area. Complete all training prior to the beginning of the System Acceptance Testing. Provide training material, manuals, and other handouts to serve not only as subject guidance, but also as quick reference for use by the students. Deliver course material in reproducible form immediately following the course.

B. Subject Area

Provide the training sessions at the required durations as listed in the Table below. A more detailed description of the required content of each training session is provided in the following sections.

Subject	Minimum Duration
DMS Signs Including:	1 Day

DMS operation	4 Hours	
DMS troubleshooting and repair	4 Hours	
Advanced Queue Detection Warning System Including: MVD Unit Event Processor Wireless Communication Systems		1 Day

18.3 REQUIRED CONTENT AND FORMAT

A. Equipment Training

Provide training for the above listed components and ensure the individual sessions address the following:

- Theory of operation
- Installation
- Operation
- Preventative maintenance of equipment
- Trouble shooting and equipment diagnostics
- Integration of equipment with field hardware, central hardware, and software components.

18.4 MEASUREMENT AND PAYMENT

Training will be paid for on a Lump Sum basis.

Payment will be full compensation for fees associated with labor, lecturers, travel and lodging, hosting facilities, manuals, handouts and reproducible materials, demonstration and training aids, other incidentals, etc.

Payment will be made under:

Pay Item	Pay Unit
Training.....	Lump Sum

STANDARD SPECIAL PROVISION
AVAILABILITY OF FUNDS – TERMINATION OF CONTRACTS

(5-20-08)

Z-2

General Statute 143C-6-11. (h) Highway Appropriation is hereby incorporated verbatim in this contract as follows:

(h) Amounts Encumbered. – Transportation project appropriations may be encumbered in the amount of allotments made to the Department of Transportation by the Director for the estimated payments for transportation project contract work to be performed in the appropriation fiscal year. The allotments shall be multiyear allotments and shall be based on estimated revenues and shall be subject to the maximum contract authority contained in *General Statute 143C-6-11(c)*. Payment for transportation project work performed pursuant to contract in any fiscal year other than the current fiscal year is subject to appropriations by the General Assembly. Transportation project contracts shall contain a schedule of estimated completion progress, and any acceleration of this progress shall be subject to the approval of the Department of Transportation provided funds are available. The State reserves the right to terminate or suspend any transportation project contract, and any transportation project contract shall be so terminated or suspended if funds will not be available for payment of the work to be performed during that fiscal year pursuant to the contract. In the event of termination of any contract, the contractor shall be given a written notice of termination at least 60 days before completion of scheduled work for which funds are available. In the event of termination, the contractor shall be paid for the work already performed in accordance with the contract specifications.

Payment will be made on any contract terminated pursuant to the special provision in accordance with Article 108-13(E), of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures*, dated July 1, 2006.

STANDARD SPECIAL PROVISION

ERRATA

(7-21-09)

Z-4

Revise the *Standard Specifications for Roads and Structures July 2006* on all projects as follows:

Division 1

Page 1-1, replace AREA - American Railway Engineering Association with *American Railway Engineering and Maintenance of Way Association*.

Page 1-7, remove –L- in middle of page after INVITATION TO BID and before LABORATORY.

Page 1-25, 102-16(R), move 2nd paragraph to left margin. It is not a part of this subarticle, but part of the entire article.

Division 2

Page 2-9, Subarticle 225-1(C), 1st paragraph, 2nd line, last word, add a “d” to make the word grade become *graded*.

Page 2-15, Subarticle 226-3, 5th paragraph, first line, replace the word *in* with the word *is*.

Page 2-23, Subarticle 235-4(B)(9), at the end of the sentence, replace finished greater with finished *grade*.

Page 2-28, Article 260-3, First paragraph, second line, remove the word *foot*.

Division 3

Page 3-13, Article 340-4, Second paragraph, change Flowable Backfill to Flowable *Fill*

Division 4

Page 4-29, Article 420-13(A) Description, change reference from Section 1082 to *Article 1081-6*.

Page 4-40 Subarticle 420-17(F) first line, change Subarticle 420-17(B) to *(B) herein*.

Page 4-70, Article 442-13(B) Second sentence, change SSPC Guide 6I to SSPC Guide *6*.

Pages 4-72, 4-74, 4-76, at the top of the page, substitute the heading Section 452 with Section *450*.

Page 4-79, at the top of the page, substitute the heading Section 450 with Section *452*

Page 4-80, change 452-7 to 452-*6* at the top of the page.

Page 4-80, change Pay Item ____Steel Pile Retaining Walls, to *Sheet* Pile Retaining Walls.

Page 4-88, 462-4, Title, Replace last word Measurement with the word *PAYMENT*

Division 5

Page 5-8, Article 501-15 Measurement and Payment, delete the 4th paragraph that begins The quantity of lime, measured as provided ...

Page 5-14, Article 520-11 Measurement and Payment, first paragraph, second line, delete *will be*.

Division 6

Page 6-3, Article 600-9, 2nd Paragraph on this page, replace 818-5 with 818-4.

Pages 6-30 and 31, Subarticle 610-3(A)(13) Move 2 paragraphs from the margin to the right under the number (13).

Page 6-43, Article 610-8, 4th paragraph, remove the first *the*

Page 6-44, 2nd full paragraph, 1st sentence, delete the first *and* and add *transverse* just before cross-slope control.

Page 6-51, at the top of the page, add **610-14** on the same line, and just before the heading MAINTENANCE.

Page 6-53, Article 620-4 sixth paragraph, second line; the word that should be *which*.

Page 6-66, title, Replace EXISTNG with **EXISTING**

Page 6-66, Article 657-1, Description, first sentence, replace PS/AR (hot-poured rubber asphalt with *hot applied joint sealer*.

Page 6-66, Article 657-2, replace PS/AR (Hot-Poured Rubber Asphalt with the following:

Item	Section
<i>Hot Applied Joint Sealer</i>	1028-2

Page 6-67, at the top of the page, substitute the heading Section 654 with Section **657**.

Page 6-67, Article 657-3 Construction Methods, 2nd paragraph, replace PS/AR sealant with *hot applied joint sealer*.

Page 6-71, 660-9(B)(1), Replace the first sentence of the first paragraph with the following:

Using the quantities shown in Table 660-1, apply asphalt material to the existing surface followed by an application of No. 78 M or lightweight aggregate.

Page 6-89; Add a period at the end of the last sentence at the bottom of the page.

Page 6-90, Article 663-5, first paragraph, first sentence, change 50oF to **50°F**; third paragraph, fourth sentence change 325oF to **325°F**.

Division 7

Page 7-12, at the top of the page, substitute the heading Section 710 with Section **700**.

Page 7-15, Article 710-9, 4th paragraph, last line, change 710-11(B) to 710-10(B).

Division 8

Page 8-13, Article 808-3, 4th Paragraph, third line, replace Eexcavation with **Excavation**

Page 8-35, Article 848-2, Item: Replace Cncrete with **Concrete**

Division 9

Page 9-2, add **901-3** just before CONSTRUCTION METHODS

Division 10

Page 10-12, near bottom of page add (C) before Proportioning and Mixing of Modified Compositions, which should be bold type.

Page 10-28, at the top of the page, substitute Section 1006 for 1005.

Page 10-54, Subarticle 1018-2A), First line, substitute (B) for II, third line, substitute (B)(2) for II-b.

Pages 10-56, 10-58, 10-60 at the top of the page, substitute Section 1018 with Section **1020**.

Page 10-84, Table 1042-1, Class 2, Maximum, change from 23r to **23**.

Page 10-84, Article 1042-2 Testing, last sentence, replace the word alterations with the word **cycles**.

Page 10-100, Table 1056-1, replace on the line for Trapezoidal Tear Strength:

Type 1	Type 2	Type 3		Type 4
		Class A	Class B	Soil Stabilization
45 lb	75 lb	--	--	75 lb

Page 10-116, Subarticle 1070-10, first paragraph, second sentence, add **or** just before cold-forged sleeve.

Pages 10-136 through 10-147, at the top of the page, substitute Section 1074 with Section **1072**.

Page 10-157, Article 1077-11, first paragraph, change the reference from Subarticle 420-18(B) to Subarticle 420-**17**(B).

Page 10-200, Subarticle 1080-14(B), change reference to ASTM D335**9**

Page 10-211, at the top of the page, substitute Section 1081 with Section **1082**.

Page 10-229, add **1088-6 BLANK** on the line above 1088-7 TUBULAR MARKERS.

Page 10-244, add **1089-10 BLANK** and **1089-11 BLANK** on the lines just above 1089-12 FLAGGER.

Page 10-272, delete Article 1098-6 in its entirety. Renumber Articles 1098-7 through 1098-17 as Articles 1098-6 through 1098-16 consecutively.

Division 12

Page 12-21 Add **1266-2** just before the heading MATERIALS.

Division 14

Page 14-33, Article 1413-6, first paragraph, first sentence, first line, replace made with **paid for**.

Division 15

- ❑ Page 15-2 add **1500-4** just before the heading WEEKEND, NIGHT AND HOLIDAY WORK.
- ❑ Page 15-4, Subarticle 1505-3(A)(2), replace the 2nd line with the following: ***Provide shielding or shoring as required under Section 150 or as required elsewhere in the contract.***
- ❑ Page 15-5, add **1505-6** on the same line and just before the heading MEASUREMENT AND PAYMENT. (Remove the period after PAYMENT.)
- ❑ Page 15-6, Article 1505-6(3), delete *in Section 1175* and replace it with *elsewhere in the contract*.
- ❑ Page 15-8, add **1510-4** on the same line and just before the heading MEASUREMENT AND PAYMENT.
- ❑ Page 15-10, substitute **BLANK** for CONSTRUCTION REQUIREMENTS on the same line and just before 1515-4.
- ❑ Page 15-10, substitute **CONSTRUCTION REQUIREMENTS** for General Requirements
- ❑ Page 15-10, Article 1515-4, add (***D***) just before the bolded Fire Hydrants.
- ❑ Page 15-13, Article 1520-3, 8th paragraph, add ***pipe*** after diameter.
- ❑ Page 15-22, add **1540-3** on the same line and just before the heading CONSTRUCTION REQUIREMENTS.
- ❑ Page 15-28, Replace 1550-6 METHOD OF MEASUREMENT with ***MEASUREMENT AND PAYMENT.***

Division 16

- ❑ Page 16-12, Subarticle 1632-1(C) ¼ Inch hardware cloth, change the minimum width from 24 inches to 48 inches.

END

STANDARD SPECIAL PROVISION

MINIMUM WAGES

(7-21-09)

Z-5

FEDERAL: The Fair Labor Standards Act provides that with certain exceptions every employer shall pay wages at the rate of not less than SEVEN DOLLARS AND TWENTY FIVE CENTS (\$7.25) per hour.

STATE: The North Carolina Minimum Wage Act provides that every employer shall pay to each of his employees, wages at a rate of not less than SEVEN DOLLARS AND TWENTY FIVE CENTS (\$7.25) per hour.

The minimum wage paid to all skilled labor employed on this contract shall be SEVEN DOLLARS AND TWENTY FIVE CENTS (\$7.25) per hour.

The minimum wage paid to all intermediate labor employed on this contract shall be SEVEN DOLLARS AND TWENTY FIVE CENTS (\$7.25) per hour.

The minimum wage paid to all unskilled labor on this contract shall be SEVEN DOLLARS AND TWENTY FIVE CENTS (\$7.25) per hour.

This determination of the intent of the application of this act to the contract on this project is the responsibility of the Contractor.

The Contractor shall have no claim against the Department of Transportation for any changes in the minimum wage laws, Federal or State. It is the responsibility of the Contractor to keep fully informed of all Federal and State Laws affecting his contract.

LISTING OF MBE & WBE SUBCONTRACTORS

Sheet _____ of _____

* The Dollar Volume shown in this column shall be the Actual Price Agreed Upon by the Prime Contractor and the MBE and/or WBE subcontractor, and these prices will be used to determine the percentage of the MBE and/or WBE participation in the contract.

**** Must have entry even if figure to be entered is zero.**

This form must be completed in order for the Bid to be considered responsive and be publicly read. Bidders with no MBE and/or WBE participation must so indicate this on the form by entering the word or number zero.

EXECUTION OF BID
NON-COLLUSION AFFIDAVIT, DEBARMENT CERTIFICATION AND GIFT BAN CERTIFICATION

CORPORATION

The person executing the bid, on behalf of the Bidder, being duly sworn, solemnly swears (or affirms) that neither he, nor any official, agent or employee of the bidder has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, and that the Bidder intends to do the work with its own bonafide employees or subcontractors and is not bidding for the benefit of another contractor.

In addition, execution of this bid in the proper manner also constitutes the Bidder's certification of status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. § 133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF CONTRACTOR

Full name of Corporation

Address as prequalified

Attest _____

Secretary/Assistant Secretary
Select appropriate title

By _____

President/Vice President/Assistant Vice President
Select appropriate title

Print or type Signer's name

Print or type Signer's name

CORPORATE SEAL

AFFIDAVIT MUST BE NOTARIZED

Subscribed and sworn to before me this the

_____ day of _____, 20____

NOTARY SEAL

Signature of Notary Public

Of _____ County

State of _____

My Commission Expires _____

EXECUTION OF BID
NON-COLLUSION AFFIDAVIT, DEBARMENT CERTIFICATION AND GIFT BAN CERTIFICATION
PARTNERSHIP

The person executing the bid, on behalf of the Bidder, being duly sworn, solemnly swears (or affirms) that neither he, nor any official, agent or employee of the bidder has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, and that the Bidder intends to do the work with its own bonafide employees or subcontractors and is not bidding for the benefit of another contractor.

In addition, execution of this bid in the proper manner also constitutes the Bidder's certification of status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. § 133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF CONTRACTOR

Full Name of Partnership

Address as Prequalified

By

Signature of Witness

Signature of Partner

Print or type Signer's name

Print or type Signer's name

AFFIDAVIT MUST BE NOTARIZED

Subscribed and sworn to before me this the
day of _____ 20_____.

NOTARY SEAL

Signature of Notary Public

of _____ County

State of _____

My Commission Expires: _____

EXECUTION OF BID
NON-COLLUSION AFFIDAVIT, DEBARMENT CERTIFICATION AND GIFT BAN CERTIFICATION
LIMITED LIABILITY COMPANY

The person executing the bid, on behalf of the Bidder, being duly sworn, solemnly swears (or affirms) that neither he, nor any official, agent or employee of the bidder has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, and that the Bidder intends to do the work with its own bonafide employees or subcontractors and is not bidding for the benefit of another contractor.

In addition, execution of this bid in the proper manner also constitutes the Bidder's certification of status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. § 133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF CONTRACTOR

Full Name of Firm

Address as Prequalified

Signature of Witness

Signature of Manager

Individually

Print or type Signer's name

Print or type Signer's Name

AFFIDAVIT MUST BE NOTARIZED

Subscribed and sworn to before me this the

NOTARY SEAL

_____ day of _____ 20__.

Signature of Notary Public

of _____ County

State of _____

My Commission Expires: _____

EXECUTION OF BID
NON-COLLUSION AFFIDAVIT, DEBARMENT CERTIFICATION AND GIFT BAN CERTIFICATION
JOINT VENTURE (2) or (3)

The person executing the bid, on behalf of the Bidder, being duly sworn, solemnly swears (or affirms) that neither he, nor any official, agent or employee of the bidder has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, and that the Bidder intends to do the work with its own bonafide employees or subcontractors and is not bidding for the benefit of another contractor.

In addition, execution of this bid in the proper manner also constitutes the Bidder's certification of status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. § 133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF CONTRACTOR

Instructions: **2 Joint Venturers** Fill in lines (1), (2) and (3) and execute. **3 Joint Venturers** Fill in lines (1), (2), (3) and (4) and execute. On Line (1), fill in the name of the Joint Venture Company. On Line (2), fill in the name of one of the joint venturers and execute below in the appropriate manner. On Line (3), print or type the name of the other joint venturer and execute below in the appropriate manner. On Line (4), fill in the name of the third joint venturer, if applicable and execute below in the appropriate manner.

(1)	<hr/>		<hr/>
	Name of Joint Venture		
(2)	<hr/>		<hr/>
	Name of Contractor		
	<hr/>		<hr/>
	Address as prequalified		
	<hr/>	By	<hr/>
	Signature of Witness or Attest		Signature of Contractor
	<hr/>		<hr/>
	Print or type Signer's name		Print or type Signer's name
	<i>If Corporation, affix Corporate Seal</i>	and	
(3)	<hr/>		<hr/>
	Name of Contractor		
	<hr/>		<hr/>
	Address as prequalified		
	<hr/>	By	<hr/>
	Signature of Witness or Attest		Signature of Contractor
	<hr/>		<hr/>
	Print or type Signer's name		Print or type Signer's name
	<i>If Corporation, affix Corporate Seal</i>	and	
(4)	<hr/>		<hr/>
	Name of Contractor (for 3 Joint Venture only)		
	<hr/>		<hr/>
	Address as prequalified		
	<hr/>	By	<hr/>
	Signature of Witness or Attest		Signature of Contractor
	<hr/>		<hr/>
	Print or type Signer's name		Print or type Signer's name

If Corporation, affix Corporate Seal

NOTARY SEAL

Affidavit must be notarized for Line (2)

Subscribed and sworn to before me this
____ day of _____ 20__

Signature of Notary Public
of _____ County
State of _____
My Commission Expires: _____

NOTARY SEAL

Affidavit must be notarized for Line (3)

Subscribed and sworn to before me this
____ day of _____ 20__

Signature of Notary Public
of _____ County
State of _____
My Commission Expires: _____

NOTARY SEAL

Affidavit must be notarized for Line (4)

Subscribed and sworn to before me this
____ day of _____ 20__

Signature of Notary Public
of _____ County
State of _____
My Commission Expires: _____

EXECUTION OF BID
NON-COLLUSION AFFIDAVIT, DEBARMENT CERTIFICATION AND GIFT BAN CERTIFICATION
INDIVIDUAL DOING BUSINESS UNDER A FIRM NAME

The person executing the bid, on behalf of the Bidder, being duly sworn, solemnly swears (or affirms) that neither he, nor any official, agent or employee of the bidder has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, and that the Bidder intends to do the work with its own bonafide employees or subcontractors and is not bidding for the benefit of another contractor.

In addition, execution of this bid in the proper manner also constitutes the Bidder's certification of status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. § 133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF CONTRACTOR

Name of Contractor

Individual name

Trading and doing business as

Full name of Firm

Address as Prequalified

Signature of Witness

Signature of Contractor, Individually

Print or type Signer's name

Print or type Signer's name

AFFIDAVIT MUST BE NOTARIZED

Subscribed and sworn to before me this the

NOTARY SEAL

_____ day of _____ 20__.

Signature of Notary Public

of _____ County

State of _____

My Commission Expires: _____

EXECUTION OF BID
NON-COLLUSION AFFIDAVIT, DEBARMENT CERTIFICATION AND GIFT BAN CERTIFICATION
INDIVIDUAL DOING BUSINESS IN HIS OWN NAME

The person executing the bid, on behalf of the Bidder, being duly sworn, solemnly swears (or affirms) that neither he, nor any official, agent or employee of the bidder has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, and that the Bidder intends to do the work with its own bonafide employees or subcontractors and is not bidding for the benefit of another contractor.

In addition, execution of this bid in the proper manner also constitutes the Bidder's certification of status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. § 133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF CONTRACTOR

Name of Contractor _____
Print or type Individual name

Address as Prequalified

Signature of Contractor, Individually

Print or type Signer's Name

Signature of Witness

Print or type Signer's name

AFFIDAVIT MUST BE NOTARIZED

Subscribed and sworn to before me this the

_____ day of _____ 20__.

NOTARY SEAL

Signature of Notary Public

of _____ County

State of _____

My Commission Expires: _____

DEBARMENT CERTIFICATION

Conditions for certification:

1. The prequalified bidder shall provide immediate written notice to the Department if at any time the bidder learns that his certification was erroneous when he submitted his debarment certification or explanation that is file with the Department, or has become erroneous because of changed circumstances.
2. The terms *covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded*, as used in this provision, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549. A copy of the Federal Rules requiring this certification and detailing the definitions and coverages may be obtained from the Contract Officer of the Department.
3. The prequalified bidder agrees by submitting this form, that he will not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in NCDOT contracts, unless authorized by the Department.
4. For Federal Aid projects, the prequalified bidder further agrees that by submitting this form he will include the Federal-Aid Provision titled *Required Contract Provisions Federal-Aid Construction Contract (Form FHWA PR 1273)* provided by the Department, without subsequent modification, in all lower tier covered transactions.
5. The prequalified bidder may rely upon a certification of a participant in a lower tier covered transaction that he is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless he knows that the certification is erroneous. The bidder may decide the method and frequency by which he will determine the eligibility of his subcontractors.
6. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this provision. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
7. Except as authorized in paragraph 6 herein, the Department may terminate any contract if the bidder knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available by the Federal Government.

DEBARMENT CERTIFICATION

The prequalified bidder certifies to the best of his knowledge and belief, that he and his principals:

- a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- b. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records; making false statements; or receiving stolen property;
- c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph b. of this certification; and
- d. Have not within a three-year period preceding this proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- e. Will submit a revised Debarment Certification immediately if his status changes and will show in his bid proposal an explanation for the change in status.

If the prequalified bidder cannot certify that he is not debarred, he shall provide an explanation with this submittal. An explanation will not necessarily result in denial of participation in a contract.

Failure to submit a non-collusion affidavit and debarment certification will result in the prequalified bidder's bid being considered non-responsive.

☐

Check here if an explanation is attached to this certification.

North Carolina Department of Transportation

BID FORM

WBS ELEMENT: 42597.3.1

TIP NUMBER: SS-4902AB

COUNTIES: Carteret

DESCRIPTION: Advanced Queue Detection Warning System on NC 58 Bridge over Intracoastal Waterway

BID OPENING: March 9, 2010

ITEM	SECT	DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT BID
1	800	MOBILIZATION	1	LS		
2	SP	METER BASE/DISCONNECT COMBINATION PANEL	2	EA		
3	SP	2" CONDUIT STUB-OUT FOR UNDERGROUND ELECTRICAL SERVICE	2	EA		
4	SP	DMS FEEDER CONDUCTORS, 4-WIRE THWN #8 AWG STRANDED COPPER	40	LF		
5	SP	PHONE SERVICE	3	EA		
6	SP	MICROWAVE VEHICLE DETECTOR UNIT	1	EA		
7	SP	MICROWAVE VEHICLE DETECTOR UNIT WITH INTERNAL RADIO	1	EA		
8	SP	COMPOSITE POWER/SERIAL COMMUNICATIONS CABLE	40	LF		
9	SP	EVENT PROCESSOR	1	EA		
10	SP	900 MHZ CONTACT CLOSURE RADIO	2	EA		
11	SP	900 MHZ SERIAL RADIO	1	EA		
12	SP	DMS	2	EA		
13	SP	DMS-1 STRUCTURE (STEEL POST)	1	LS		
14	SP	DMS-2 STRUCTURE (PEDESTAL)	1	LS		
15	SP	FOOTINGS FOR DMS-1 STRUCTURE	6	CY		
16	SP	FOOTINGS FOR DMS-2 STRUCTURE	8	CY		
17	SP	CENTRAL SOFTWARE MODIFICATIONS	1	LS		
18	SP	FURNISH MICROWAVE VEHICLE DETECTOR UNIT	1	EA		
19	SP	FURNISH EVENT PROCESSOR	1	EA		
20	SP	FURNISH 900 MHZ CONTACT CLOSURE RADIO	1	EA		
21	SP	FURNISH DMS CONTROLLER	1	EA		
22	SP	TRAINING	1	LS		

TOTAL BID FOR PROJECT: _____

CONTRACTOR _____

ADDRESS _____

Federal Identification Number _____ Contractors License Number _____

Authorized Agent _____ Title _____

Signature _____ Date _____

Witness _____ Title _____

Signature _____ Date _____

THIS SECTION TO BE COMPLETED BY NC DEPARTMENT OF TRANSPORTATION

This bid has been reviewed in accordance with Article 103-1 of the Standard Specifications for Roads and Structures 2006.

Reviewed by NCDOT _____ *Date* _____
Contract Officer

Accepted by NCDOT _____ *Date* _____
Division Engineer